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The Copperbelt of Northern Rhodesia

R. W. STEEL

THE COPPERBELT OF NORTHERN RHODESIA covers an area of about 1,600 square miles on the Congo–Zambezi watershed, immediately adjacent to the boundary of the Belgian Congo and to the mining area of Katanga province (Fig. 1). It is, therefore, only a relatively small district in the heart of the immense area of Central Africa: yet for geographers it has a particular interest since it is now second only to the U.S.A. among the world's copper producers, being responsible for more than 15 per cent of the total output, and also because it has certain special problems of transport resulting from its isolated position in the centre of a great continent. It has, moreover, been developed only very recently and is still very much in the stage of being opened up. It is a new, striking and rapidly evolving landscape, with fresh signs of human interference with natural conditions to be seen on all sides.

Ancient workings of copper were found at Kansanshi in 1899 and later at Bwana Mkubwa and Luanshya, but there could be no commercial exploitation until a railway had been built. This came from the south, following the construction in 1903 of the railway bridge across the Zambezi, just below the Victoria Falls. The line was continued northward, past the site of the present capital of Northern Rhodesia, Lusaka, to Broken Hill, where the lead, zinc and vanadium mine was opened in 1906. In 1909 the line reached the Belgian Congo border, by which time mineral developments had started in Katanga, where copper oxides occurred near the surface and were of richer copper content than those of Northern Rhodesia. Copper was worked intermittently at Bwana Mkubwa, but little other development took place in Northern Rhodesia. As recently as 1924 the whole territory produced less than £400,000 of exportable commodities, of which copper accounted for only a very small part.

The situation was completely changed by the discovery in 1925 of sulphide ores with between 3 and 5 per cent of copper at a depth of about 100 feet. Such ores when worked by the flotation process are very valuable, whereas oxide ores of similar grade are of relatively small value. The field proved ideally suited for rapid and large-scale development because, once the geology of the area was understood, great masses of ore could be proved by a relatively small number of drill-holes. So the scepticism of 1926 and even of 1928 (when the area was still ignored by the principal members of the International

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➤ Professor Steel is John Rankin Professor of Geography in the University of Liverpool. His paper was read to Section E of the British Association for the Advancement of Science at its meeting at Sheffield on 31st August, 1956.

Copper Cartel) was replaced by the optimism of 1930, when it was established that there were reserves of over 500 million tons of ore containing more than 20 million tons of copper.

Within a few months the area now known as the Copperbelt was in the middle of a construction boom, and Ndola was talked of as a second Johannesburg. Europeans entered the area in considerable numbers, and an African labour force of 30,000 was employed. This prosperity was short-lived, however, for the world economic depression quickly hit Central Africa: the price of copper fell from £72 a ton in 1930 to only £27 in 1931. Development and building had everywhere to be suspended, and only two of the new mines remained open. The number of Africans employed fell to 6,000, and many Europeans had to be dismissed and left the country.

During the 'thirties the situation gradually improved. Exports of blister copper rose from 3,000 tons in 1931 to 103,000 tons in 1933, and after 1935 electrolytic copper was also produced, so that the combined export of 1938 totalled 220,000 tons. Production was maintained and increased during the Second World War, despite temporary, but at the time very acute, problems of European manpower and African labour, and notwithstanding the grave shortage of railway rolling-stock, the congestion in the ports, particularly Beira in Portuguese Mozambique, and the difficulties and dangers of the high seas. Peak war-time production of 266,000 tons was reached in 1943, when 35,000 Africans were employed at the mines.

These war-time increases in output were but small, however, compared with what has happened during the last ten years. The rise in production has been steady from 175,000 tons in 1945 to the post-war record output of 424,000 tons in 1954; while, because of the greatly increased price of copper in recent years, the value in 1954 was nearly ten times the figure for 1945. Even more valuable was the smaller production of 1955—the result of a prolonged strike early in the year—when the total output of 383,000 tons was worth nearly twelve times that of 1945. Blister copper production has remained fairly stationary in recent years, the increase being largely accounted for by the growth in the output of electrolytic copper: this trend will become even more marked when the new electrolytic copper refinery at Ndola is completed in 1958, when it will handle 55,000 tons of copper each year with double that amount from 1960.

The Copperbelt occupies a part of the great African plateau lying more than 4,000 feet above sea-level and broken in places by remnants of higher surfaces. The all-important Lower Bwana outcrop, in which the ore occurs, is only narrow and follows a sinuous course across the area, now marked by the various mines. Until the development of the mines the whole district was covered by the dominant ecological type of Central Africa—the *Brachystegia-Isoberlinia* complex which, with amazingly little variation, extends from the

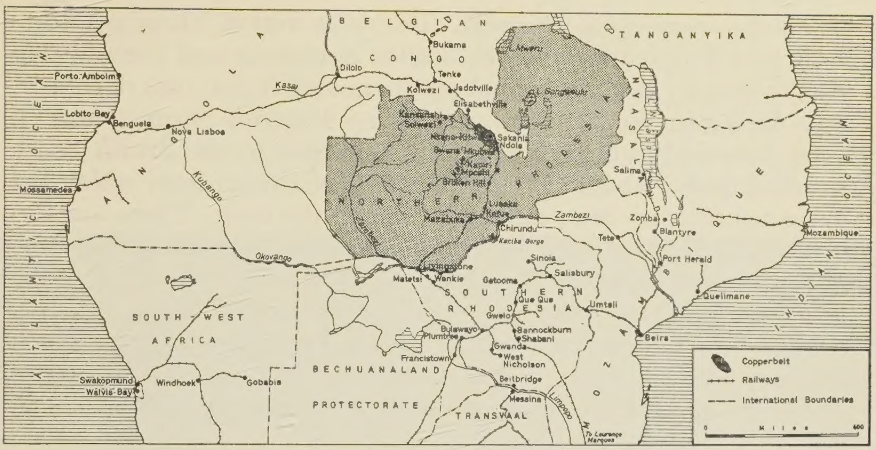

Fig. 1.—The Copperbelt and Northern Rhodesia in relation to other parts of central and southern Africa.

Limpopo right up through the Rhodesias into East Africa. Much of this vegetation type remains: mine buildings, houses and lines of communication have made little impression on it. As recently as 1934 the average density of population for the Ndola District, in which the Copperbelt lies, was only 2·7 to the square mile. Yet to-day this area includes half of all the Europeans in Northern Rhodesia, nearly one-eighth of the total African population, and five of the eight townships of Northern Rhodesia which can properly be regarded as being "urban communities." In thirty years, in fact, an urban and industrialized landscape has been created to replace an almost wholly natural environment in which there was only a very small and exclusively rural and indigenous population. Right in the heart of the African bush are the signs and symbols of twentieth century industrialism alongside the crudest and most primitive of villages.

The four principal mining centres are all served by branches of the railway that closely follows the international boundary, usually just on the Belgian side, from Ndola to Elisabethville (Fig. 2). Ndola, the administrative, and, to some extent, commercial and distributing centre of the Copperbelt, lies a little north of the now abandoned mining township of Bwana Mkubwa. From it railways lead to the mines, two of which belong to the Rhodesian Selection Trust, Limited (R.S.T.) and two to the Anglo American Corporation of South Africa, Limited. The R.S.T. mines are Roan Antelope, 24 miles southwest of Ndola, and adjacent to the Government township of Luanshya, and Mufulira, 48 miles northwest of Ndola. The largest Anglo American mine is Nkana, with the township of Kitwe alongside: the twin-settlement of Nkana-Kitwe with 80,000 inhabitants, including nearly 10,000 Europeans, is easily the largest town in Northern Rhodesia. The Anglo American Corporation also works the Nchanga mine, near which is the township of Chingola. Ten miles west of Nkana is Chibuluma where R.S.T. have recently started operations and hope, within a year or two, to have an annual production of 16,000 tons of copper. Anglo American are actively opening up Bancroft (named after J. Austen Bancroft, formerly Consulting Geologist to the British South Africa Company) about 15 miles north of Nchanga, from which the railway has recently been extended through the bush. There are also prospects of developments further to the west, well away from the present Copperbelt, in the Kansanshi–Solwezi area.

The populations of these towns are summarized in Table I, giving the total and European numbers for census and other years for which reasonably reliable statistics are available. In 1931 the townships were so new that there is no record of their African populations; when the depression struck the Copperbelt there were just over 6,000 Europeans: this figure had doubled by 1949, trebled by 1951, and, according to recently issued figures of the 1956 census, is now increased by about 550 per cent. Bancroft appeared for the first time in 1956 with 1,800 Europeans even before the mine went into production. While these large and prosperous European communities have been developing, the number of Africans employed has grown rapidly and an ever-increasing number of dependants and of Africans employed in ancillary industries and service occupations has also settled in the area. Whereas in 1931 there were, probably, barely 20,000 Africans in the Copperbelt towns, there were possibly 80,000 by 1939, and well over a quarter of a million at the present time. Apart from the Rand

Table I

THE COPPERBELT TOWNS: TOTAL AND EUROPEAN POPULATIONS, 1931–56
(Totals, where available, are in italics; all other figures are European totals)

	1931	1939	1946	1949	1951	1953	1956
Nkana–Kitwe	1,762	*20,800* 2,453	2,951	*51,500* 4,067	*53,525* 5,225	*72,200* 7,200	9,700
Luanshaya–Roan Antelope	1,855	*24,000* 2,167	2,741	*46,700* 3,200	*51,176* 4,676	*59,600* 5,600	6,000
Mufulira	722	*18,300* 1,464	2,147	*27,900* 2,146	*39,903* 3,703	*49,700* 4,700	5,600
Nchanga–Chingola	636	*6,300* 300	1,163	*20,100* 1,087	*21,802* 2,602	*28,400* 3,400	4,600
Ndola	1,406	*c. 18,000* 1,247	1,242	*26,200* 2,000	*27,607* 2,907	*39,500* 4,500	6,800
Bancroft							1,800
Totals		*c. 87,400*		*172,400*	*194,013*	*249,400*	
Totals (European)	6,381	7,631	10,244	12,500	19,113	25,400	34,500

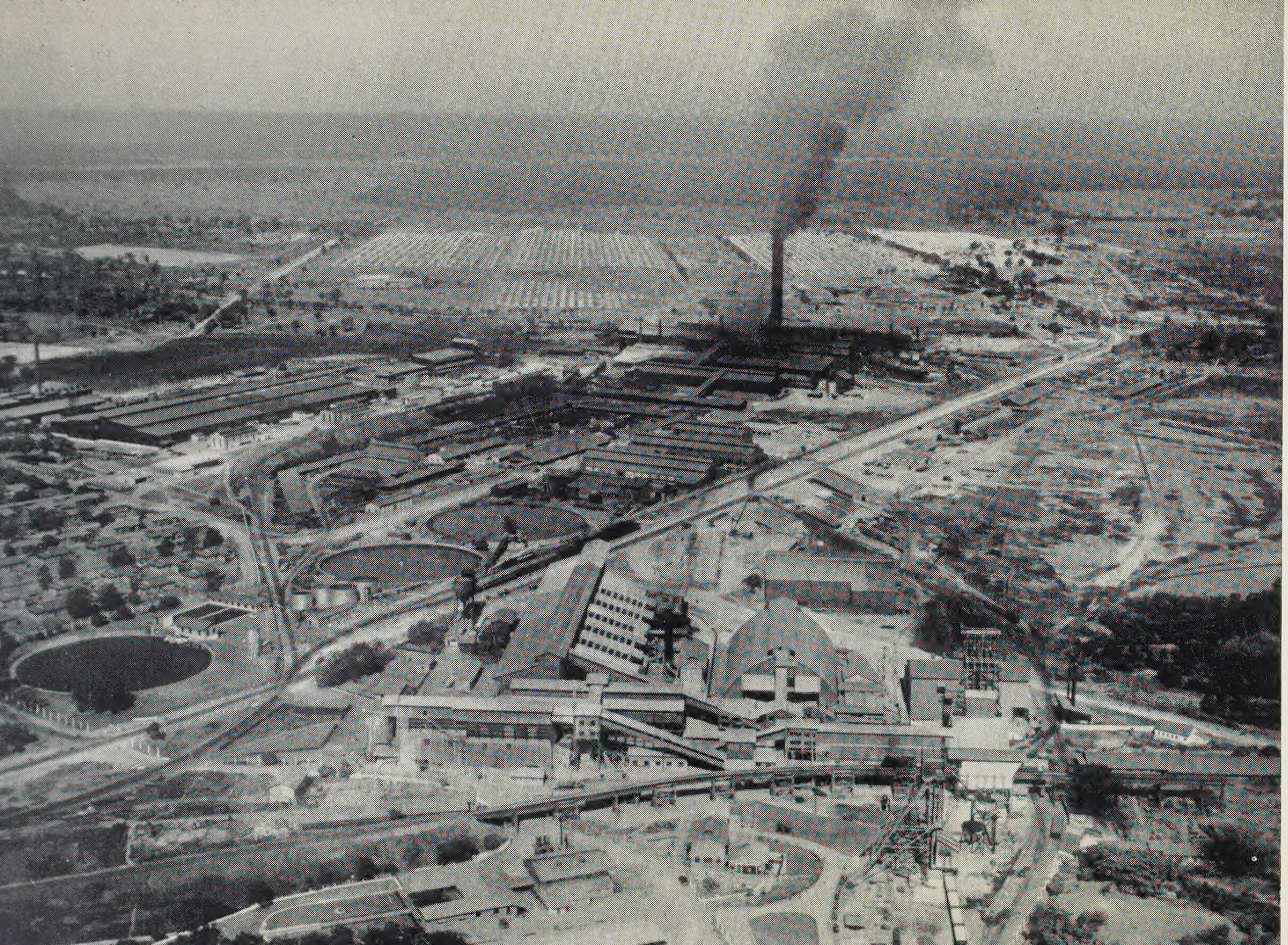

Plate I. An aerial view of Nkana. In the centre background is the high stack of the smelter, with the mine workshop and stores area immediately in front. The refinery is to the left, and slightly forward, of the smelter. Two shaftheads are in the right foreground. There is a portion of the European township of Nkana on the left behind the thickener tank. In the background beyond the smelter is the Wusikili African township. This photograph should be compared with Fig. 3. *All plates are reproduced by courtesy of the Anglo American Corporation of South Africa, Limited.*

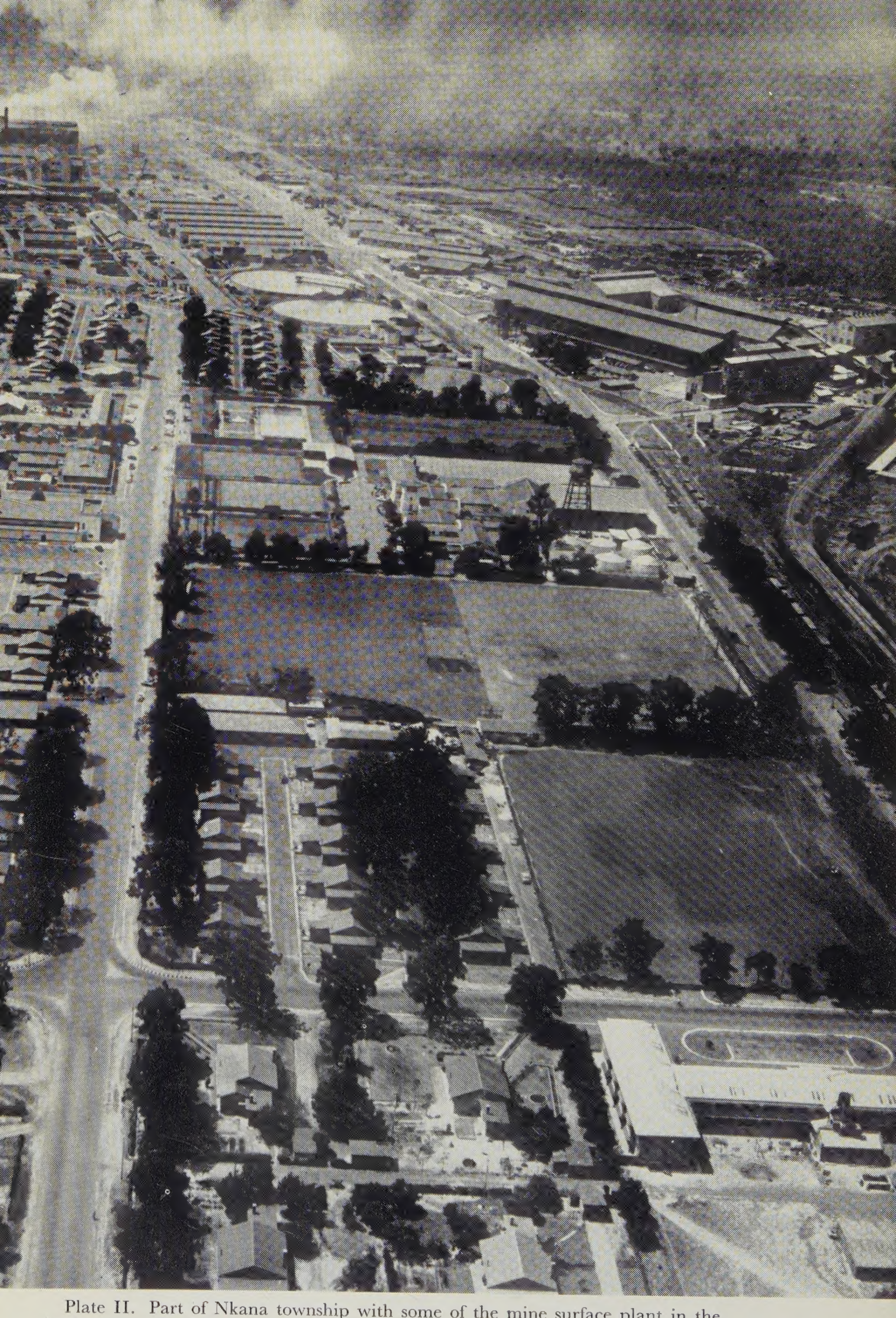

Plate II. Part of Nkana township with some of the mine surface plant in the background. In the foreground are houses and flats for the Company's European employees. The Rhokana Club buildings are to the left of the water tower, with its playing fields in the right foreground.

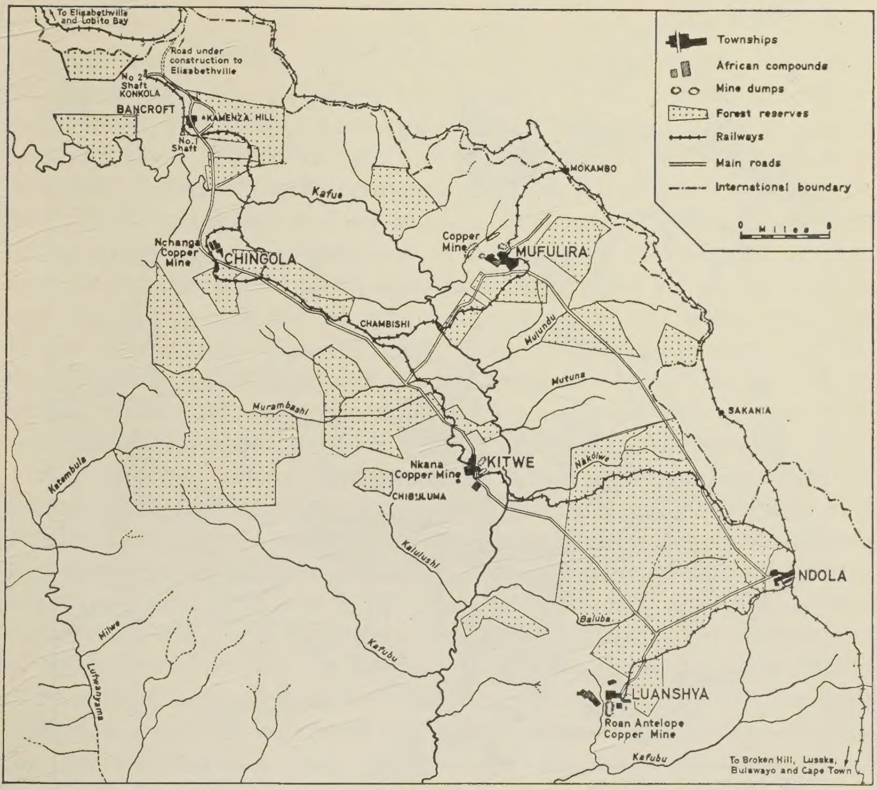

Fig. 2.—The Copperbelt, showing the principal mines, communications and forest reserves.

conurbation in the Union of South Africa there is no comparable concentration of population anywhere in the interior of Southern Africa.

The nature of this concentration of population and of its resultant problems can best be seen by reference to specific cases, those of Nkana-Kitwe, the largest, and Bancroft, the youngest, of the Copperbelt mining communities. Fig. 3, based with permission upon a part of the Directorate of Colonial Surveys 1/50,000 series of Northern Rhodesian maps, and Plates I and II give an impression of the amount of building and the concentration of activity within a limited area—all in the heart of a district that until yesterday was extremely remote, scarcely inhabited and very backward.

Compared with conditions in many African mining areas, including those in the Union of South Africa, individual houses are reasonable as regards construction, size and facilities, though the planning of the African townships such as Wusikili at Nkana is perhaps somewhat unimaginative. Much has been done to provide community services, to which the African from the bush has hitherto been unaccustomed. The shops, offices, cinemas, garages and other central buildings in Kitwe (Plate III) are superior to those found in any other Central

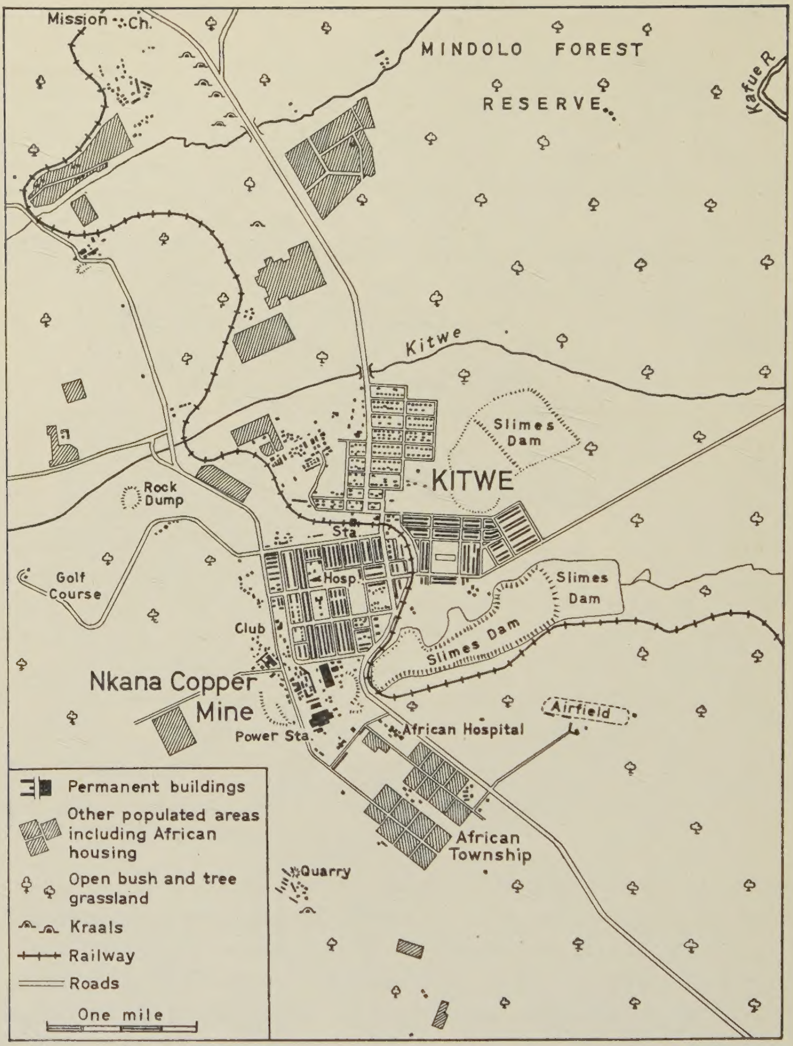

Fig. 3.—Nkana-Kitwe. Map based on the 1/50,000 map of Northern Rhodesia, sheet 1228 SW 3, published by the Directorate of Colonial Surveys, and reproduced with the permission of H.M. Stationery Office. Crown Copyright.

African town, except Salisbury and Bulawayo. In short, everything possible is being done, for both European and African communities, to encourage settlement and to prevent the developments in the Copperbelt from seeming to be only ephemeral. Nevertheless, one need not be a particularly shrewd observer to recognize, beneath the bustle and enthusiasm of Kitwe to-day, plenty of doubts and uncertainties on the part of the government, the mine management and the men, and shared by European and African alike.

Bancroft is of interest because it is the newest and, potentially, the most integrated of all the Copperbelt towns. Government and mine have worked closely together, in the light of experience gained in the past elsewhere in the Copperbelt, to produce a co-ordinated plan for both Government and Mining townships, in the centre of which will stand Kamenza hill, surrounded by a natural park. Far more trees are being left in the African township than has been the case in the older centres such as Nkana-Kitwe; and in the African shopping districts branches of flourishing departmental stores in Kitwe set new standards in architectural design and lay-out and in the services that are offered to the community. Development is taking place so rapidly that it is hard to visualize the Bancroft of the future (see Plate V). A few months ago the railway was still under construction, and the bridge over the Kafue river was far from complete: now the railway is open and the mine went into production at the beginning of 1957. The immediate annual production is likely to be between 43,000 and 48,000 tons, but already it is hoped to reach a figure of about 85,000 tons by 1960.

But however careful the planning, however forward-looking the organization, however close the co-operation between Government and Mining Company—and for that matter, whatever the degree of partnership between European and African—developments of this nature and scale are bound to create problems of various sorts, and of these the Copperbelt has good measure indeed. Undoubtedly the advantages of such developments are numerous—among them, the stimulation of general activity resulting from economic prosperity, the value of high living-standards for European immigrants and of regular wage-earning for African workers, and the considerable range of services and amenities that can be offered to the community, both European and African, because of the revenues derived from mining. Recognition of these assets must not, however, blind us to the existence of a debit side, and some mention must be made of the Copperbelt's special difficulties.

On the social side, it must be admitted that the contact of a very diverse European population with large numbers of mixed and, generally speaking, fairly backward Africans is creating problems towards the solution of which very little has so far been achieved. Large numbers of the white miners are Afrikaners from the Union of South Africa, whence they derive their views on politics, on industrial and race relations, and on the place of the African in industry. Most of the Africans are, like the Europeans, immigrants to the area, a district that is agriculturally hard and unprofitable, so that there are relatively few forms of occupation and employment apart from the copper-mining industry. There is, therefore, a whole set of problems commonly referred to as "detribalization," "the stabilization of labour," and "the urbanization of the African": behind these ugly terms are hidden a complex series of difficulties concerned not only with the African population as a whole but with thousands of individual Africans, who find themselves rather bewildered and confused by their first close and rather harsh contact with the industrialism of a new age and of the western world.

There are two outstanding and interrelated economic problems: the supply of power, and the provision of communications. Power has come mainly from the Wankie coalfield of Southern Rhodesia where there are vast reserves of high quality coal, usually within 80 to 200 feet of the surface. But supplies have often been short in recent years on the Copperbelt, partly because of inadequate production at Wankie and partly owing to shortage of trucks and the general congestion of the single line of Rhodesia Railways that joins Wankie to Ndola. In 1953 Anglo American acquired a controlling interest in Wankie, and since then the situation has improved considerably. When coal supplies fail, the mines turn to the local sources of timber (Fig. 2 shows the extent of the Copperbelt's forest reserves), but wood is becoming increasingly expensive and the supply is by no means inexhaustible. Arrangements have now been made to import electricity from the Belgian Congo during the next six years, and great importance is attached to the Federation's own plans for the generation of hydro-electricity. Two projects have been carefully examined, one at the Kariba gorge of the Zambezi, and the other on the Zambezi's tributary, the Kafue, probably at a dam site a few miles below the township of Kafue, about 220 miles from Nkana in a straight line.* Work at Kariba has already started. Its electricity will be much in demand in the Rhodesian "Midlands," as the Salisbury–Gatooma–Que Que–Gwelo–Bulawayo industrial area is called, but major consumers will also be the copper mines. They have already loaned £20 millions to enable the scheme to go forward, at the same time agreeing to pay a surcharge on Kariba power used between 1961 and 1967 to yield a further £10 millions. For the moment work is concentrated at Kariba, and the plans for Kafue have been shelved. But the fact that two major hydro-electric schemes have been considered for the area is some indication of the scale and intensity of the mining and industrial development in the Federation, and especially in the Copperbelt.

The problem of the adequacy of communications has already been mentioned as a partial cause of the difficulties of power supply; but even more serious is the problem of the export of copper. The ore must, of necessity, be refined as near to the mines as possible: but even then a vast quantity of copper (424,000 tons in the record year of 1954) has to be railed, mostly by the long, circuitous, single-tracked, and badly congested line from Ndola to Lusaka, Livingstone, Wankie, Bulawayo, Salisbury, Umtali and the Portuguese port of Beira in Mozambique, a distance of 1,450 miles. It is tempting to look at a map such as Fig. 1, and to see several alternative and better routes. The Benguela railway to Lobito Bay, for example, is only about 1,300 miles long, but long-established agreements guarantee much of the export to Beira where, in any case, there are special ore-loading facilities: diversion to Lobito would also disturb the existing links between the Wankie coalfield and the Copperbelt.* Other routes to Atlantic ports have been considered: a line from Matetsi into South West Africa has been discussed, and one from Plumtree in Southern Rhodesia across the northern part of the Bechuanaland Protectorate to connect with Gobabis and so with Walvis Bay has been partially surveyed. Even much more modest schemes have been found to present unexpected, and sometimes insuperable, difficulties. The linking-up, for example, of West Nicholson with Messina, the northernmost station in the Union of South Africa, would call for the complete reconstruction and re-alignment of the existing Bulawayo–West Nicholson line. The joining of Kafue in Northern Rhodesia and Sinoia in Southern Rhodesia is often referred to as if it were an inevitable corollary to the building of the Kariba dam. Certainly on the map it seems an obvious line, but it appears that the engineering works required to carry such a line across the Zambezi valley and up its very steep northern slopes would be so costly as to make construction most unlikely. Even the Kariba dam is being built not by the laying of a temporary railway but by the building of an approach road from Lusaka and the nearby Chilanga cement works to the dam-site.

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* See the note in *Geography*, vol. xl, 1955, pp. 274–6.

A recent provision is an additional line from the Federation at Bannockburn (Southern Rhodesia) to another port in Mozambique, Lourenço Marques, by way of Guija. The line, opened during 1955, does not directly deal with much, if any, Copperbelt traffic; it is hoped, however, that it will help greatly in the reorganization of Rhodesia Railways' traffic so as to ease congestion on the Bulawayo–Salisbury–Beira line and reduce shipping delays at Beira. There are also plans for the centralized control of signalling throughout the Rhodesias as an alternative to the double-tracking of some of the railways which would not, it seems, be an economic proposition.

These various difficulties are examples of the problems that must be faced when an isolated, inland, and hitherto undeveloped area such as the Copperbelt is suddenly touched by the effects of industry and commerce; and the projected further expansion of the Copperbelt, with the coming of Bancroft and Chibuluma into production, may not be attained without very serious attention being given to them.†

Finally, brief mention must be made of the political problems to which these great economic developments give rise. Because the Copperbelt's railways lead to Portuguese ports on both Indian and Atlantic Oceans, and also depend on a long section in Belgian territory, from Sakania through Tenke to Dilolo, the Federation must rely very greatly upon the goodwill of its non-British neighbours. The railway and port facilities available in both Angola and Mozambique are largely due to British enterprise, the investment of British capital, and sometimes, perhaps, a certain amount of diplomatic British pressure. The proximity of the Rhodesian Copperbelt and Belgian Katanga raises a further set of problems since they are administered under two such very different systems with widely contrasting objectives: these are based on political philosophies with strikingly divergent views on fundamental matters such as that of African advancement in the mining industry and of the land rights of the indigenous African. Complications also result from the juxtaposition of the Federation with the Union of South Africa—in, for example, the working out of "partnership" in the one and *apartheid* in the other. The meaning of these policies takes on a special significance in the Copperbelt with its growing Afrikaner population and its steadily increasing African (as well as European) urban and industrial population, and with the close ties that exist between the strong European Mineworkers' Union in the Copperbelt and the European Unions at the mines of the Witwatersrand. However isolated the Copperbelt may seem on the map, it is right in the centre of some of the great issues that are causing concern in Central and South Africa at the present time. The tensions that in recent years have so often shown themselves at the mines, in the form of disturbances, riots and strikes, are symptoms of the general unrest in Africa to-day, wherever there has been very sudden economic, social or political advance.

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* Copper has recently been railed to Lobito Bay under an agreement signed early this year by the Federal, Belgian and Portuguese Governments. The agreement lays down maximum tonnages of copper that may be railed through Lobito and stipulates that a through rail rate from Northern Rhodesia, equivalent to the rail rate to Beira, will be granted.

† An article about transport in the Copperbelt is published on pp. 93–5 of this issue.

The Copperbelt of Northern Rhodesia is one of Africa's very prosperous spots at the moment, but it is also very much one of its problem areas, and it would be wrong to view its wealth and at the same time to ignore its dangers. It is a part of Africa that has been transformed overnight and whose productivity forms the basis of much of the Federation's prosperity to-day. In a matter of twenty or thirty years the cultural landscape has been entirely transformed, while the area surrounding the Copperbelt, and the lives of the people living there, have so far been changed but little. Prosperous and growing towns have been created where not so long ago there were only a few primitive settlements. Refineries, cooling towers, power lines, modern blocks of buildings, and the whole paraphernalia of the urban and industrial life of the twentieth century now dominate what until yesterday was just another, and a rather undistinguished, piece of African bush. Such an economic revolution raises a host of sociological, political and cultural, as well as geographical, problems. On the success or failure of the tackling of these problems will depend the future progress and prosperity not only of the Copperbelt and of Northern Rhodesia, but of the whole venture of the Federation of Rhodesia and Nyasaland.

Transport in the Rhodesian Copperbelt

F. B. WELLS

THE COPPERBELT OF NORTHERN RHODESIA, whose largest town, Kitwe, is of such recent growth that it is not usually shown on school atlases, has many problems due to its rapid increase in population and its industrial set-up in the heart of Black Africa. Chief of these is the question of transport. First let us look again at the position of the Copperbelt on the map of Africa. It stretches about 100 miles from northwest to southeast along the Belgian Congo border, where that country inserts what is generally termed a "pedicle," 45 miles wide, far into the heart of Northern Rhodesia. It lies between 12½ and 13½ degrees south of the equator, nearly 900 miles from the east coast, 1,000 miles from the west coast and 1,500 miles from the south coast in direct lines. Even from the Zambezi river it is 200 miles, and this is navigable only intermittently because of falls at Tete and the shallow channel in its lower course, especially in the dry season. Unfortunately, the Federation has no ports despite the attempts of Rhodes, Jameson and others to acquire Beira in the nineties of last century, almost as soon as the pioneers first trekked towards Salisbury. Beira is still the nearest port connected by railway to the Copperbelt but there is only a single line most of the way, and in a passenger train (which is the fastest type available) the journey takes at least four days via Lusaka, Livingstone, Bulawayo, Salisbury and Umtali. A more direct route is proposed crossing the Zambezi at the Kariba Dam, the great hydro-electric project on which work is now well under way. That route would cut out Wankie, whose coalfield is the source of fuel for all railway transport in the Federation; an alternative source may exist in fields as yet unexploited south of Umtali.

According to the atlas there are two alternative routes through the Belgian Congo. One runs north to Port Francqui on the Kasai, and crosses also the Belgian Katanga copper-mining area. But even Belgian goods seldom use the route; for from Port Francqui at present the transport is by river steamer to Leopoldville, which may take more than a fortnight, and then by railway to Matadi, whose dock facilities are not first-class. Moreover the railway uses wood for fuel, and apart from the fact that larger quantities than of coal are needed for stoking, there is the drawback that, since the rains there may last

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➤Miss Wells, who retired recently from teaching at the Orme Girls' School, Newcastle, Staffs., spent three months at the beginning of 1956 in the Copperbelt, during a tour of the Rhodesias, the Union and South West Africa. Her article is based on her experiences there.

up to 9 months, wood is often too damp to burn. I have heard of a train taking 12 days to make the journey from Elisabethville to Port Francqui, which is scheduled for 3 days! The other route via the Congo goes to Lobito Bay or Benguela. This passes for most of its course through Portuguese Angola, through more open savannah country than the former, and with more (at least potential) products to keep down freights.

This question of return freights is a difficult one for all Rhodesian railways and those of the Copperbelt particularly. This mining region is an industrialized oasis in a desert of unproductiveness, or "Suburbia in the Bush." For at least five hundred miles, in any direction, there is no comparable area of dense population or even of agricultural production. The native population is sparse and lives on subsistence agriculture and pasture; the white population is negligible outside the Copperbelt towns. Consequently, apart from concentrates of copper, and of lead and zinc from Broken Hill, there is no outward freight. Inwards come bulky foodstuffs, cars and machinery for the mines, so that the traffic is not balanced as regards bulk. Because of this, Cape Town and Port Elizabeth can also be classed as Copperbelt ports. One may reach them almost as quickly as Beira, although they are so much farther away; and the areas through which these lines pass are more densely populated and productive.

Before leaving the subject of railway transport one might add that even intercommunication between Copperbelt towns is poor by rail. It takes eight hours to go from Chingola in the northwest to Ndola in the southeast, a distance of about 80 miles by road. The deviousness and consequent slowness of the railway in Northern Rhodesia is due to the fact that it was built by contractors paid by the mile. A curve round a hill or a railway winding up a valley was more to their interest than a cutting or a tunnel!

So we come to road transport. The roads do not suffer from this defect. They are for the most part uninterestingly straight and wide, and make their way uncompromisingly over the gentle undulations of the 4,000-foot plateau from one Copper town to another and south from Ndola to Lusaka and beyond. Their chief defect is their surface. Some have now a double-width strip of tarmac or an even wider centre, though some are still only single-strip tarmac, and a few, even main ones, are still only dirt roads. (Single- or double-strip means available for one or two lorries abreast, and not like the strip roads of Southern Rhodesia with two 1-foot strips of tarmac set apart by a dirt centre, the usual width of a car's wheels.) The dirt roads develop pot-holes and deep furrows in the rainy season, particularly in areas of soft lateritic soil, unmixed with the stiffer clay from anthills, or with the granite chippings available from a few escarpments; in the dry season dirt roads are unpleasantly sandy. Even the tarred roads are bordered on each side with equally wide strips of dirt, and at the

Plate III. Modern stores and other buildings in the central part of Kitwe.

Plate IV. Train carrying ore from the Mindola shaft to the concentrator of the Nkana mine.

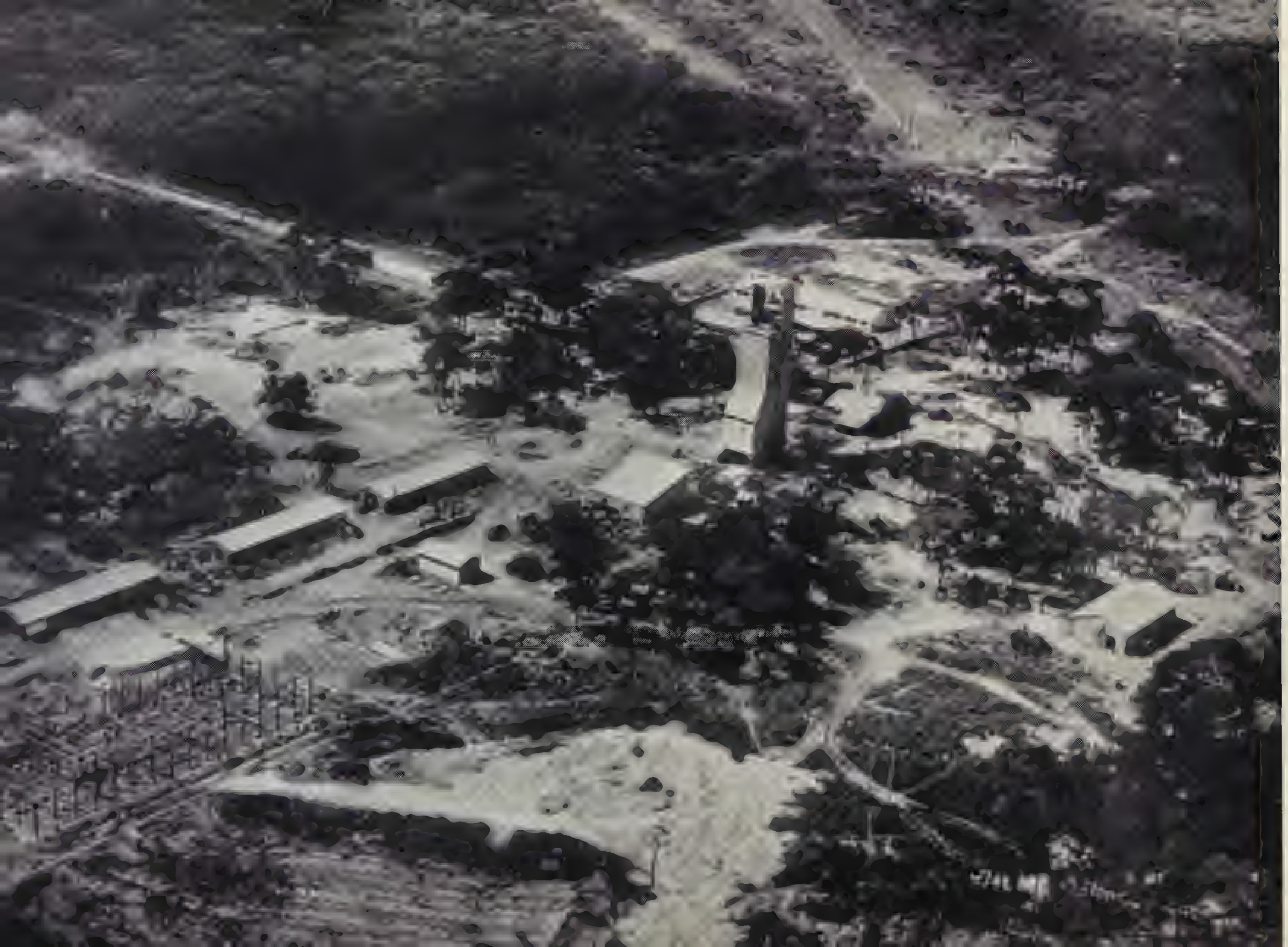

Plate V. Air view of the No. 1 shaft (Kirila Bomwe South) at Bancroft. The temporary central offices are behind the concrete headframe. Beyond the offices are the switching station and the clearing for the power line.

junction of dirt and tar in the rainy season are pot-holes and mud liable to cause skids. Nevertheless, roads offer a more rapid form of transport than rail within the Copperbelt area and as far south as Lusaka. In so far as there is one important junction for transport it is Ndola, though Kitwe in the Copperbelt itself tends to be the shopping and amusement centre. Road transport to Salisbury and thence to Beira is much more direct than rail, for the main road linking the two territorial capitals keeps south of the Kafue river to its junction with the Zambezi and crosses the latter at the Chirundu bridge. Bridges in general are only available for one-line traffic, and their approaches are often difficultly steep. Road transport to the west into Angola is quite undeveloped, the road from Chingola to Mwinilunga being only a dirt one.

Though it affects traffic to the Northern Province of Northern Rhodesia more than the Copperbelt itself, mention should be made of a transport difficulty caused by the Congo "pedicle." This piece of Belgian territory, 45 miles wide where the dirt main road from Mufilira in the Copperbelt to Fort Rosebery in the Northern Province crosses it, is a continual thorn in the side of traders. If the Customs House at Mokambo in Belgian territory were moved 200 yards to the Elisabethville turn, this North Rhodesian link road could be free of Customs supervision. With the increasing fish trade from Lake Mweru to the Copperbelt, and the encouragement of rice production in the Lakes region, the position will be aggravated. Government officials pass the Customs easily, but in a missionary society lorry taking goods to a station in the Lake Mweru area, I have been held up two hours! This may cause one to miss the vehicular ferry at Chembe across the river Luapula, by which one re-enters the Federation, for it stops working at 6 p.m., about dusk. This ferry, which has been considerably improved in the last few years, may itself become a bottleneck, but at present it is sufficient to cope with the normal traffic.

To encounter more than six cars in a mile of road outside towns is to be on a busy road in Northern Rhodesia. This helps to explain why road construction costs about £1,000 per mile for a dirt road; and why at intervals along the main roads one sees native settlements for their upkeep, put up by the Public Works Department.

Apart from the main roads and railways, the native paths from village to village must be much in the state in which Livingstone knew them a hundred years ago. Travel is monotonous in the extreme; for native settlements are usually away from the roads as the forest growth along them is preserved by Government Forestry regulations, and wood fuel is essential to the African villager. His *chitimene* clearings, or circular mounds for pumpkins or mealies, may be seen near anthills along the road, but except in the Congo "pedicle" one sees little sign of African people when one is travelling by road.

Emigration from Southern Tunisia

JOHN I. CLARKE

NOWHERE HAS THE EUROPEAN IMPACT ON AFRICA been more revolutionary than at its northern and southern extremities, in French North Africa and in the Union of South Africa, where temperate climatic conditions have been conducive to European settlement. In both extremities the presence of large numbers of Europeans has meant the superimposition of modern West European civilization on less advanced native cultures. There has been little fusion of the two groups of peoples, despite their growing interdependence in economic spheres. The contrast between the two economies, the advanced, exporting economy of the Europeans and the backward, self-*in*sufficient economy of the natives, is still marked, although attenuated in recent years by the rapid but unequal evolution of native peoples, by their improved agricultural techniques, and by their importance as a labour-force for the Europeans.

A large proportion of the Europeans live in the towns, which are expanding rapidly with the enormous influx of natives from rural areas. Urban growth is due not only to the attractions of employment and social amenities, but also to the expulsion from the countryside actuated by diverse factors, such as droughts, population pressure, dispossession of lands, and tribal disintegration. The overcrowded, evil-smelling, sordid shanty-towns which are the common canker of the large and otherwise beautiful modern cities are symptomatic of the social, economic and political problems associated with the co-existence of two greatly contrasted ways of life. However, further comparison of these two extremities of Africa is unwise, for there are wide differences in relief, race, religion, and also in the origin and interests of the Europeans present.

In French North Africa[1] over four-fifths of the 1,600,000 Europeans live in towns, and, indeed, two-fifths in the three cities of Algiers, Casablanca, and Tunis. Furthermore, the European rural population is largely concentrated in the moister Mediterranean zone rather than in the steppe and semi-desert lands to the south. The greatly transformed landscapes of the former contrast markedly with the comparatively unchanged scenes of the latter, where pastoral nomadism still prevails despite the decline in the power and wealth of the nomad. Before the French occupation cultivators in the steppe zone were confined to villages in the mountains, to oases, and, in Tunisia, to the

➤This paper is based on research work carried out in Tunisia during 1950–2. Dr. Clarke is a lecturer in geography in the Durham Colleges of the University of Durham.

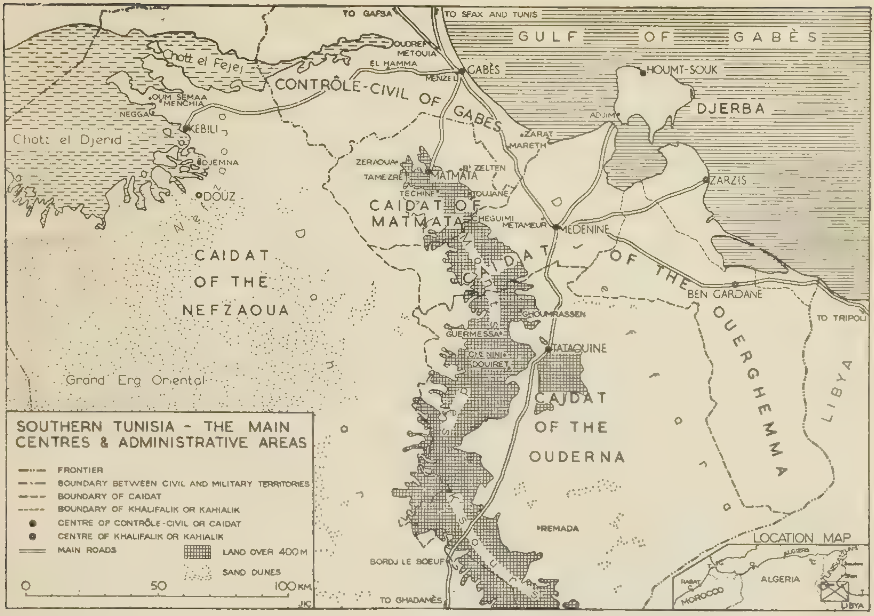

Fig. 1.

Sahel, south of Sousse, and to the islands of refuge, Djerba and the Kerkena. The density of population in these localities was far too high for the meagre natural resources, so that since the liberation from the tyranny of nomadic domination they have become reservoirs from which has flowed a steady stream of emigrants to the towns, to the mines, to the more developed Mediterranean zone, and to France. Many forms of emigration exist. It may be permanent, temporary, or periodic, and sometimes certain communities practise special occupations.

Recently the subject has been studied in detail in Morocco,[2] but elsewhere only isolated examples have been examined. Southern Tunisia (Fig. 1) provides an excellent study area, for physical diversity has engendered social and economic diversity.

South of the naked mud-flats of the Chott el Djerid and Chott el Fejej the natural conditions and cultural landscape are distinct from those of Barbary. It is a transitional zone, linked physically and climatically to the Sahara, but politically and economically to the steppe and Mediterranean lands further north. A broad and undulating coastal plain, the *Djeffara*, forms the natural route into Barbary from the east, and is separated from the island of Djerba by the shallow Gulf of Bou Grara. The Djeffara is overlooked on the west by the eroded escarpment, 1,200 to 2,000 feet high, of the *Monts des Ksours*, composed of Jurassic and Cretaceous limestones dipping gently westwards. The bare dip-slope, the *Dahar*, is dissected by wadis and eventually passes into the chaos of dunes of the *Grand Erg Oriental*. On the northern fringe of the latter and round the eastern edge of the

Chott el Djerid a belt of oases, the *Nefzaoua*, owes its presence to artesian water.[3]

For centuries southern Tunisia has been a zone of contact between nomadic and sedentary societies: on the one hand, the nomads, who pasture their sheep, goats and camels on the Djeffara, the Dahar, and occasionally on the erg, and, on the other, the Berber tribesmen, known as Djebalia (men of the Djebel or hills), who live in perched villages[4] and cave-dwellings[5] in the Monts des Ksours, the oasis-dwellers of the Nefzaoua and the islanders of Djerba. Before the creation of the French Protectorate in Tunisia in 1881 and the subsequent establishment of French military authority in the form of "Bureaux des Affaires Indigènes" there existed a state of insecurity which permitted the nomads to "protect" the sedentary peoples at a fee, which meant provision of olives, cereals and dates. Deficiencies in the nomadic economy were thus rectified.

Emigration of Djebalia

The Djebalia gained little from their strenuous toil in the rocky beds of the wadis. Their olive-trees and date-palms suffered from the vagaries of climate and the occasional depredations of nomads fleeing from parched pastures in search of food. Thus, since as far back as the end of the seventeenth century, Djebalia have emigrated periodically to other parts of Tunisia, working in various occupations to obtain some supplementary means of support. Emigration was noted by French observers[6] in the early years of the Protectorate, and it appears that its main traits have changed little. But it has grown considerably, and now the economy of the Djebalia is based as much on the profits of emigration as on agriculture itself. Without those profits it is certain that the prosperity of agriculture would decline rapidly and possibly perish. In spite of the poverty of the Djebel, emigration is rarely permanent, because home-ties are strong among these Berber peoples. The men usually depart for one or two years, work very hard, live very frugally, and send home most of their earnings by postal order. When they have saved enough, they are replaced in their employment by relatives or friends, and return home to build or repair dams and cisterns, and to purchase a few trees, a plot of land or some sheep and goats. Their stay at home may last several years if rains are plentiful. Djebalia come and go in this manner until they are about 40 to 45 years old, when they settle down in their villages to look after their lands and livestock. So about one-quarter to one-third of the total male population is always absent. In drought years the proportion is higher.

Tunis has always been the centre of attraction for emigration, because, as the capital and largest city, it offers the best opportunities of employment. Men from the same village live in the same quarter,[7] and in the evening frequent the same cafés, where they gossip about news from home. However, during the past forty or fifty years many other towns in Tunisia have experienced rapid growth, especially the three ports, Bizerta, Sousse and Sfax, and to-day Djebalia can be found in most of them and even in Libya and Algeria.

Perhaps the most interesting feature of the emigration is the remarkable growth of occupational specializations. The members of each village or *cheikhat* tend to concentrate on a certain trade or occupation, which is sometimes practised throughout Tunisia. For example, the people of Ghoumrassen (Fig. 1) are known as *ftaïri*, or makers of fritters and doughnuts. About 1,500 of them, representing about one-half of the male population of the village, are scattered in the towns and villages of Tunisia, while some are in France and others as far west as Oran in Algeria and as far east as Derna in Cyrenaica. They have an almost complete monopoly of the trade in Tunisia, and have brought wealth to the picturesque white village which clings to the red cliffs of the Djebel. Similarly, men from the nearby village of Guermessa are porters and greengrocers in the vegetable market of Tunis. Practically all the newspaper boys in the capital are from Chenini; they quickly oust competitors. Others from this village sell chick-peas and monkey-nuts. Men from Tamezret in the Djebel Matmata are barmen, waiters and hotel-boys. The Beni Zelten are famous as porters who can manage the heaviest of loads, and many a baker comes from Zeraoua. The list is not exhaustive, but not all the villages of the Djebel have such specializations. From Douiret go porters, dockers, fruit-pickers and olive-traders: no specialization, although they are successful. Some villagers, like those of Toujane, have only recently felt the need for emigration, and they are finding it difficult to compete successfully with men from villages which have a long tradition of emigration.

Emigration of Djerbians

Djerba, the legendary island of the lotus-eaters, is naturally infertile but densely populated; in 1946 the census recorded 59,331 people, a density of 297 per square mile. A green mantle of olive and palm trees studded with settlements and 288 tiny white mosques presents a picture of abundance which contrasts vividly with the sparse rolling pastures of the Djeffara. The clash of the Malekite and Wahabite Moslem sects, the compact and ancient Jewish community, the fishermen and artisans, the survival of Berber speech (although Arabic is far more current), and the unusual commercial emigration combine to make Djerba a fascinating study.[8]

Like the Mozabites of southern Algeria and the Chleuh of the Anti-Atlas in southern Morocco, Djerbians seem to have an innate ability as shopkeepers and traders, but particularly as grocers. "Grocer" and "Djerbian" are synonymous terms in most parts of Tunisia, for the islanders hold a quasi-monopoly of this trade. About

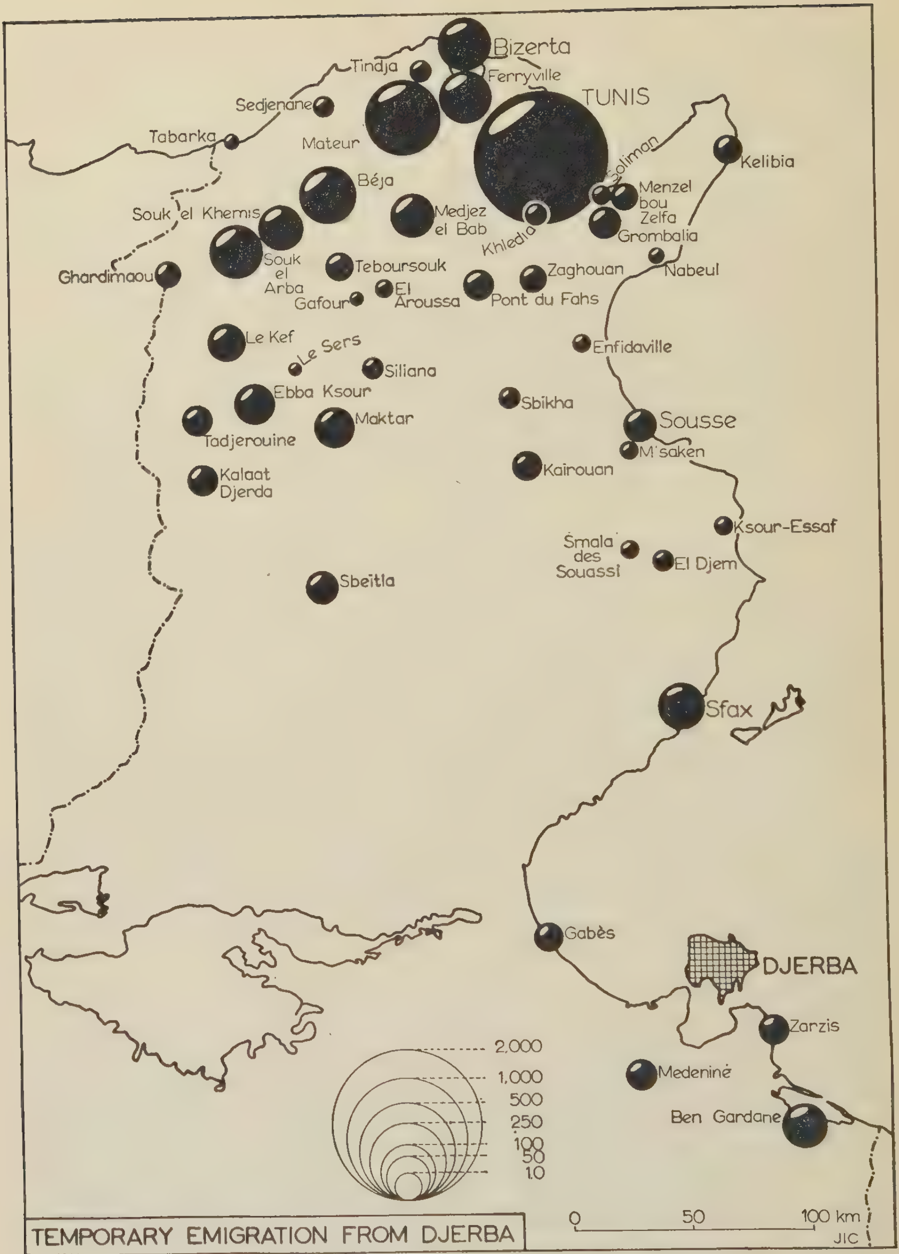

Fig. 2.—Source of data: Contrôle-Civil of Djerba.

four-fifths of the 6,500 Djerbian traders are grocers, while the remainder trade in cloth, hosiery or pottery, or own cafés or restaurants; 65 per cent of the emigrant traders are in Tunis, but they are numerous in all the large towns (Fig. 2), and may also be found in Morocco, Algeria, Libya, Egypt, Turkey and France. It is said that there are even two Djerbian grocers in New York. Only in Sfax do Djerbians find difficulty in establishing themselves as grocers, because Sfaxians themselves have a bent for commerce, and, since they are a solid community allowing no interlopers, they buy amongst themselves.

A thrifty, sober-living and extremely hard-working people, the Djerbians have built an extraordinary commercial "empire" based on traditional family co-operation. Each shop has an owner, an associate, who is really both a manager and a partner, and a young lad who is either an apprentice or an employee. Often, there is a sleeping-partner who provides the funds. Family relationships are important, for they mean a diminution in overheads, and when one member of the business returns home for a year or two he is automatically replaced by a relative. Djerbians rarely settle permanently in the towns, but always aim at a comfortable retirement on their native isle, usually buying a small plot of land and a few olive-trees to keep themselves occupied. Commercial emigration has thus caused extreme fragmentation of property and intensive agriculture.

Emigration from the Oases

The population of the oases of the south has grown very slowly because of limited supplies of water to extend cultivation, the prevalence of squalor and disease, and thirdly, emigration. Some emigrants leave to continue their education, but most are poorer folk who know no trade and depart in years of hunger. Temporary emigrants from the oases of the Nefzaoua are numerous, especially from the "peninsula" between the Chott el Djerid and the Chott el Fejej (Fig. 3), and in May 1952 they represented 15 per cent of the total population. Some are specialized, bakers, masons, notaries and writers, gardeners, and shopkeepers, but many are settling down in Tunis, Sfax, Gafsa and Gabès. Likewise, carters from Gabès, plasterers and masons from Oudref, and greengrocers from Metouia depart northwards with the intention of returning home a few years later with a small fortune, but they are often absorbed into the towns and quickly lose their identity. Thus, co-operation and traditional ties are not as strong as among the Djebalia and the Djerbians, and emigration is more like a safety-valve than an integral part of the economy.

Emigration of Nomads

In recent years a new type of emigration has evolved, less regular, less organized and less profitable. This is the emigration of nomads, which is largely a temporary emergency measure in time of drought.

Nomadic tribes are suffering from contact with the modern world. Nomadism is in decline. The French, bringing security, motor transport, new administrative arrangements, modern agricultural techniques and schemes for the settlement of the nomads, have altered the whole balance of the economy. "Protection" of sedentary peoples is no longer possible; the old caravan traffic is virtually extinct; pastures are sometimes awkwardly limited by frontier lines, and many a sheikh spends most of his time in a village office rather than with his tribe. Moreover, the French have devoted more energies to the development of oases and the cultivation of tree-crops than to the equally difficult problem of improving pastures for the nomads; so pastures have not increased in proportion to population growth. For political as well as economic reasons, the nomad has often been treated as an anachronism to be quickly settled, and he has often suffered from the rapid change of life. The war and the great drought of 1945–8 reduced flocks to a mere handful, and now it seems doubtful if nomadism will ever regain its former status. Thus, although emigration of nomads occurred in the inter-war years it has accelerated since the end of the Tunisian campaign.

Nomadic society has lost its vitality. Tribes have split up and traditional ties have slackened. Amongst the human debris resulting from detribalization are the poorer folk who no longer possess any flocks. They form the bulk of the emigrants.[9] Naturally their number varies from year to year with the climatic conditions, and after a prolonged drought may assume the alarming character of an exodus. They go, not to make their fortune, but to flee from poverty and hunger, so that specialization is rare. Most find work as labourers and navvies.

Clearly it is difficult to distinguish between temporary emigration of nomads and summer nomadism,[10] but the former is not seasonal, involves no movement of livestock and is mainly directed towards the towns; in summer nomadism the towns are the last resort. The pattern of temporary emigration is not well defined, and varies not only between tribes but between cheikhats, fractions and families. However, it is broadly related to the degree of settlement. Former nomadic tribes, now living in *gourbis* (huts) or houses with olive and palm-trees alongside and possessing only small flocks, emigrate more freely than those tribes which are still nomadic. During a drought trees can be left, but it is then that flocks need constant attention.

At the two ends of the scale are the Accara and the nomads of the Nefzaoua. On the peninsula southeast of Djerba, the Accara, former nomads, and a few colonists have planted millions of olive-trees, and the little fishing-port of Zarzis has become the centre of a prosperous community. The Accara are industrious and fairly well educated—there are a large number of schools in the district—and the youths are attracted by the social life in the towns of the north and the prospects of permanent and remunerative jobs. Approximately one thousand are in Tunis and the other large cities. Many of the hotel-boys in the capital are from Zarzis, especially in the "de luxe" hotels. Others are barmen, waiters and owners of small cake-shops, and at least 30 families live in Tunis with no desire to return to Zarzis.

On the other hand, the nomadic tribes of the Nefzaoua, the Merazigues, Adhara, Sabria and Gherib, who pasture their flocks on the Dahar and the erg, rarely emigrate. The long post-war droughts provoked the

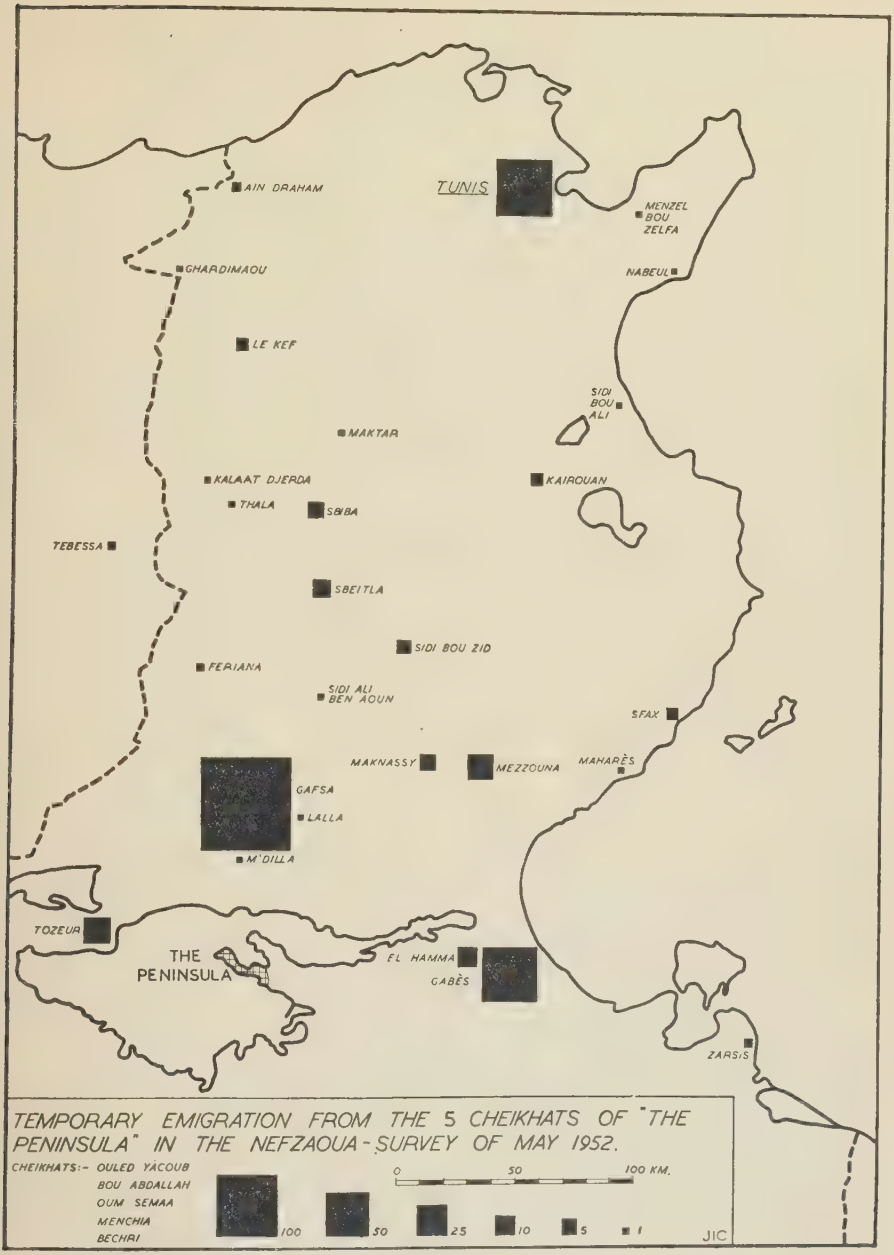

Fig. 3.

largest emigration, and then mainly among the Merazigues and Adhara, the hardest-hit tribes. About 40 Merazigues found work in the construction gangs which were rebuilding Bizerta. The Gherib and Sabria, who spend almost the whole year with their flocks, were less affected.

Between these two extremities are the semi-nomads of the Djeffara, who are at various stages of settlement. The fourteen Cheikhats of the Ouled Slim and Ouled Abd el Hamid in the Caïdat of the Ouderna provide a good example of the relationship between settlement and temporary emigration, as there is a gradation from cheikhats which are almost completely settled to those which are still semi-nomadic. Where the sedentary way of life has increased, temporary emigration is well established and there is some specialization, as porters, watchmen and *chaouchs* (attendants in government offices). Others emigrate irregularly, and the more nomadic peoples leave their circumscriptions only for the olive-gathering in the district of Zarzis or on the island of Djerba. The Touazines of the Khalifalik of Ben Gardane, semi-nomadic frontier tribesmen, find additional resources in contraband and in camel herding for other tribes, so they rarely depart. However, in bad years they invariably work in "chantiers de charité" set up by the government.

The Future

Thus southern Tunisia contains an entire series of modes of life from the completely sedentary to the completely nomadic, and the volume and character of the emigration from a particular community depends to a large extent on the relative position of that community within the series. Temporary emigration reflects the economic instability, which is due firstly to insufficient and irregular rainfall, and secondly to the effects of western methods on backward Moslem peoples. Tree-crops are the main hope for the future, for they give a surer return than flocks, but since a complete transformation to the sedentary way of life is a slow process, the south will long suffer from instability. No doubt emigration will continue and will assume the character of rural depopulation, unless great technical advances are made by man in his struggle against the desert.

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[4] Each village has a *ksar* (pl. *ksours*), or fortified granary usually perched on the summit of a hill, whence the name *Monts des Ksours*. See J. Despois, "Les greniers fortifiés de l'Afrique du Nord", *Les Cahiers de Tunisie*, Tunis, vol. i, 1953, pp. 38–60.

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Farming the Fortunate Isles

A. DOWNES

THE "FORTUNATE" ISLES OF SCILLY consist of two hundred and twenty named rocks of which but five are inhabited islands. They lie 27 miles west-south-west of Land's End in an oval group almost 11 miles in length, from Bishop Rock Lighthouse to Hanjague, and just over 5 miles in breadth from Scilly Rock to Peninnis Head, St. Mary's. This oval formation resembles a granite bathylith whose collapsed arch forms the relative shallows, between ¼ and 10 fathoms deep, of St. Mary's Road and Crow Sound, which follow the longer axis and separate the islands. Within the shallows, submerged rocks and sandbanks demand the navigational skill of a knowledgeable pilot even in shallow-draught launches. The mainland steamer, the *Scillonian*, was specially constructed to negotiate the narrow channels to St. Mary's and Penzance.

Geologically the Scilly Isles consist of an acid granite, with quartz, white and black micas and usually large phenocrysts of white orthoclase felspar. The similarity of composition and structure to the Cornish granite cannot fail to impress the petrologist. More basic varieties with much hornblende and even gneissic structures occur in boulders on most of the islands.

The granite is partially covered by a coarse sand containing angular granite fragments and called "ram," the product of a long period of weathering of the granite and attaining a maximum thickness of about twenty feet. It varies considerably in texture and is locally fine enough to be called clay by the Scillonians. Many fine exposures of ram, as on the west coast of St. Mary's and west coast of Bryher, show wave attack on this loosely consolidated weathered material, thereby supporting the theory of continued subsidence of the islands. Blown sand is probably a constituent of the ram in places, though fresh dunes are also common on most islands. "Ram" is vital to the Scillonians as the only source of soil and as the main road metal. A base of granite blocks overlain by coarse and fine ram is the surface of all but the few tarmacadam roads radiating from Hugh Town, St. Mary's. Like its tropical laterite counterpart, the ram road pits easily and the surface needs frequent renewal. This is still in part the duty of the farmer through whose land the ram road passes.

Peat growth has been widespread, but the low heather growth and root exposure suggest that present climatic conditions do not favour

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➤Mr. Downes is lecturer in geography and geology at St. Paul's College, Cheltenham. In his article he has used geological, climatological and agricultural data collected in the Scilly Isles to illustrate a "specimen farm" in a study which may be used as a teaching example.

its extension. However, with bracken, it renders considerable areas unsuited to cultivation.

Cairns and tumuli, as well as natural rock outcrops, also limit the available agricultural land. There are said to be more remains in Scilly than in the whole of Cornwall, but most of them are in poor condition and have been rifled as systematically as those of Orkney, possibly by the same Norsemen. Some remains have been found below present sea-level. Flint pebble is abundant on most island beaches and a working floor on Castle Down, Tresco, testifies to the earlier use of this material. All this points to a considerable population in prehistoric times dated as far back as 2000 B.C. but particularly in the Bronze and Iron Ages. It has been suggested that in former times the islands were a western sanctuary as Malta was in the Mediterranean, but actual habitation is supported by the stone hut bases of the ancient village of Bant's Carn, St. Mary's, recalling those of Chysauster, near Penzance, and Grimspound on Dartmoor, while rare, small finds of smelted tin may represent a more commercial role. On Tresco and Bryher ancient walls may well mark early cultivation fields concerned, no doubt, with a very different agricultural economy from that of to-day.

The soils derived from the ram and blown sand are light, nowhere exceeding a light medium loam, and sometimes as ashy as a podzol. Their natural acidity is combated somewhat by a humus derived from the wealth of vegetation encouraged by the delectably mild climate to which the Tresco tropical gardens bear witness. But the soils also require much fertilizer, up to a ton an acre. Cattle provide insufficient manure for farmers' needs, manufactured fertilizers are vital but costly, and seaweed is liberally used when the plants require most moisture in winter and spring months, though the old kelp-burning industry has died. Bristol and Waterford glass is said to owe its green-blue colour to Scillonian kelp soda.

Scillonian industries have always been varied and unusual but rarely profitable. Smuggling, shipwrecking, shipbuilding and fishing are among the defunct occupations, the last now being left to Cornishmen, apart from lobster and crab-potting. The tourist industry, said to have been started by a sea captain who opened his own hotel eighty years ago, may now be the largest single source of income. To-day the industry is a serious competitor to the farmer in the labour market. But farming has for long had its right place in the economy. At the beginning of the seventeenth century, Camden reported good crops of corn, and in the eighteenth and nineteenth centuries Scillonian potatoes provisioned ships and were traded in Gibraltar and the West Indies. There were then sheep on the islands and spinning and weaving were home industries. About 1850, sailors are said to have introduced the *Soleil d'Or* narcissus bulb from Morocco and in 1879 the first box of blooms was sent to Covent Garden. Since then the

Scillonian story has largely been one of flower farming. This article attempts to portray this modern industry through a farm study rather than from an economic viewpoint.

Table I gives a broad picture of the farming economy, showing clearly the supremacy of the daffodil bulb, the wartime increase in food crops at the expense of flowers, the increasing use of leys of rotation grass to supplement the well-stocked permanent grass, and the decline of the horse in favour of mechanization. The sharp rise in pig production is due almost entirely to one farm. The post-war rise in bulb acreage has largely been at the expense of other crops, notably the declining early potato production.

Table I

CROPS, MEN AND ANIMALS, AGRICULTURAL RETURNS FOR THE SCILLY ISLES

	Acres						*Number*				
Year	*Crops and Fallow*	*Bulbs*	*Ley Grass*	*Permanent Grass*	*Rough Grazing*	*Total*	*Labou*	*Cattle*	*Poultry*	*Pigs*	*Horses*
1938	167	703		206		1,076		433	1,000	65	147
1943	483	233	68	403	207	1,395	121	555	2,902	104	160
1946	420	274	110	383	260	1,447	210	499	4,065	87	152
1951	362	427	158	346	198	1,492	223	516	5,186	66	121
1955	250	521	196	356	208	1,531	212	540	3,048	475	92

Fig. 1 shows the plan of a St. Mary's farm of 13·7 acres, selected as a fair average between the garden smallholding and the largest farm of 32 acres. Like other farms, it is held on lease from the Duchy of Cornwall. The Dorrien-Smith family had lease of all the islands from 1896 to 1930 but now lease only Tresco. The farmstead is a two-storey house of granite blocks roofed with Cornish slate; the out-buildings are separate, the glasshouse, packing shed, cowhouse and barn being the largest. Equipment includes a horse-drawn and a tractor plough, a rotary cultivator and a bulb sterilizer in which the bulbs are soaked in water at 110° F. for 1½ hours. The farm is worked by the farmer and one labourer.

The farm plan consists essentially of two parts. The inner circle is the sheltered land in one field surrounded by granite boulder walls called "hedges." This name is not so paradoxical as one might suppose for, in such a mild climate, bracken, bramble and bushes thrive in the wall spaces and need regular cutting. The inner field is divided into smaller units called "squares," regardless of their shape, by means of "fences." The fences are windbreaks of quick-growing evergreens, mainly *Pittosporum*, originally from New Zealand, *Escallonia* and *Veronica*, but Australian eucalypts and even espalier apple trees occur. Formerly, elm was used for this purpose but, being deciduous, it gave no leafy shelter in winter when shelter was most needed. Modern fences grow about 15 feet in 5 years and last 30 years or more. Gaps in the fences allow easy movement of equipment from one square to another. It is within these squares that flower growing has been and is mainly concentrated. The outer circle of the farm is more exposed, often approaching the peneplanation level of about 130 feet above sea-level, and consists of several fields with bounding hedges but seldom in fenced squares. Most fields are in pasture or crops or ley, usually trifolium with ryegrass, or timothy. Some fields, however, are being fenced for bulb flowers to extend or replace the inner circle bulb squares, some of which have held bulbs for 30 years and whose yields are decreasing. The north-easterly slope of the chosen farm is exceptional, but though this may reduce solar insolation it increases protection against gales which are predominantly westerly.

Table II shows the land use on the farm and, again, the supremacy of the bulb. Bulb acreage on this farm has remained fairly steady at 5·5 to 6·9 acres or nearly half the farm area, a high proportion. It must be emphasized, however, that grass follows the flower from May to October and the method of working even the small squares in patches or strips allows the maximum use of land for other crops, as

Table II

LAND USE ON A SCILLONIAN FARM

Field O.S. Number	*'Square' Letter*	*Acres*	*Slope*	*Name*	**1956**	1955	1954	1953	1952	*Remarks*
160	—	1·0	NE	Farmstead, buildings, paths etc.						
”	a	·05	NE	The Alley	eP	eP	eP	eP	eP	Former track, shaded by high trees
”	b	·3	NE	Dicks Square	B	B	B	B	B	Bulbs lifted, soil fumigated 1953
”	c	·7	NE	Johns Square	B	O/B	P/M/K	T/P	B	First planted with bulbs 1853
”	d	·2	N	Orchard Square	O/B	O/B	M	L	B	
”	e	·14	N	Lower Orchard	L	B	B	B	B	
”	f	·2	NE	Top Garden	P	B	B	B	L	Eelworm, bulbs lifted 1955
”	g	·5	NE	Lower Square	L	B	B	B	B	
”	h	·2	NE	Little Square	Kg	L	B	B	B	
”	i	·13	NE	House Square	B	Kg	B	B	C	
”	j	·3	NE	Glasshouse Square	B	B	B	B	O	Soil fumigated 1952, eelworm 1956
”	k	·43	NE	Top Square	B	B	B	B	L	
”	l	·48	NE	Long Square	B	B	B	B	B	Late flowering variety
”	m	·4	NE	Path Square	B	B	B/Kg	B	K/C	Various bulb varieties
”	n	·11	NE	Little Path Square	B	B	O	P	K	
”	o	·35	NE	Outer Path Square	M/B	B/P	B	B	B	
160		5·59								
161	p	·25		Outer Square	B	B	B	B	B	Bulbs being lifted, July 1956
”	q	·2		Dutchman's Square	K	B	B	B	O	A trial square for Dutch bulbs
”	r	·34		Alla Vale Square	B	B	B	B	B	Soil fumigated 1954. Eelworm 1956
161		·79	NE							
162		1·1	NE	Inner Field	C/L	K/B/M	K/B	C/B	B	Cart track across this field
163		·91	SW	Middle Field	pG	pG	pG	pG	pG	
166		·77	SW	Barn or Top Field	pG/O	pG	pG	pG	pG	Grass sown 1943
247		1·8	SW	Big Field	B	B	B	O/eP/K	pG	Previously 63 yr. in pasture
257		·91	SW	Three Corner Field	pG	pG	pG	pG	pG	
258		·87	SW	Fortune Field	L/B	L/B	L/B	B/L	B/L	
259		·98	NE	Alla Vale Field	L/B	L/B/eP	L/B/P	L/B/M	B/L	
Total		13·72								

KEY: B—bulbs eP—early potatoes P—later potatoes O—oats T—turnips M—mangolds K—kale C—cabbage Kg—kitchen garden L—ley grass, often trifolium with ryegrass, or timothy pG—permanent grass, sown over 3 yr.

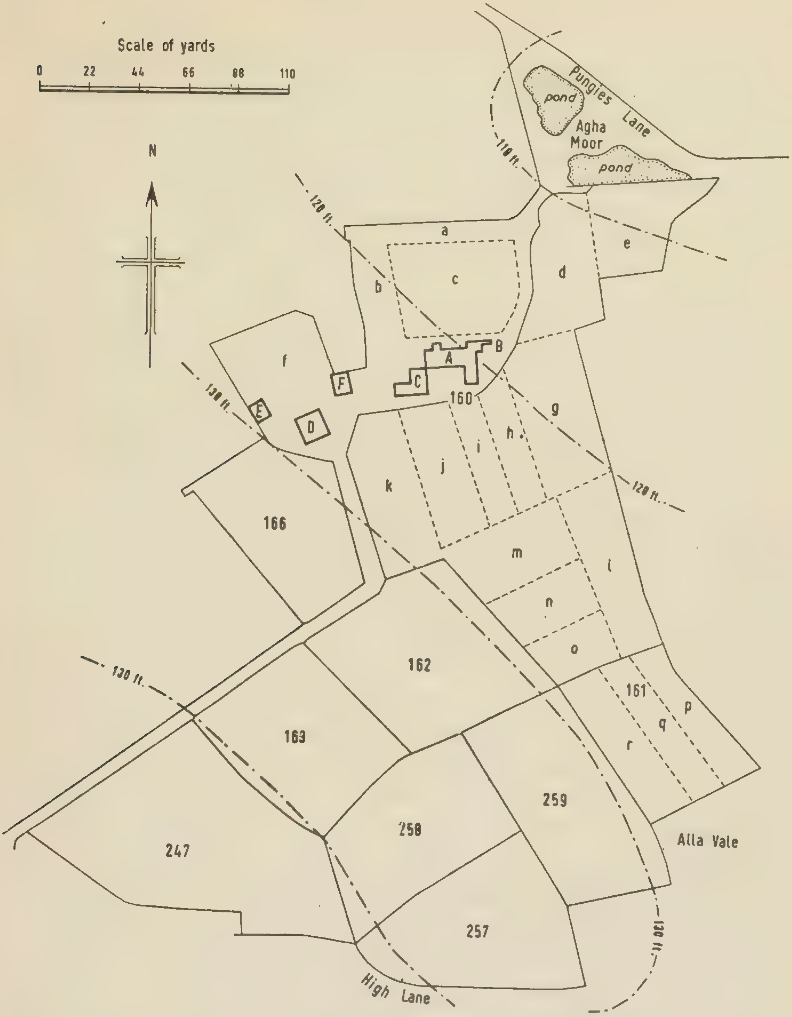

Fig. 1.—Lower Newford Farm, St. Mary's, Scilly Isles.

The fields (which have O.S. map numbers indicated by numerals) are bounded by "hedges"—stone walls of granite boulders. a to r: field divisions or "squares," bounded by "fences"—high evergreen windbreaks. A: dwelling house; B: wash house; C: glasshouse, packing shed and bulb sterilizer; D: milking shed, store and garage; E: poultry house; F: implement shed and store.

in squares 160d (1955–6) and 160m (1954). Field and square names are obviously modern and utilitarian, like so many place names in Scilly. The few names of ancient significance are shown on the plan.

An attempt to relate farming operations to climatic factors in Table III is intended to be used as a pictorial display. Monthly temperatures range from 45° F. to 60° F. and daily ranges rarely exceed the seasonal range. The rainfall of 32 inches is below that of parts of the English Midlands. Snow falls on average on one day in

Table III

The Year Round on a Scillonian Farm

	January	*February*	*March*	*April*	*May*	*June*	*July*	*August*	*September*	*October*	*November*	*December*	*Year*
Average hours of DAYLIGHT	8·5	10	12	14	15	16	16	14	12	11	9	8	
Average hours per day of SUNSHINE	2·0	2·9	4·5	6·3	6·6	7·4	6·8	6·3	5·3	3·8	2·8	1·7	
Mean monthly TEMPERATURE °F.	45·7	45·3	46·0	48·6	52·5	57·2	60·2	60·8	58·6	53·8	49·8	47·4	52·2
Mean monthly RAINFALL inches	3·0	2·6	2·4	1·9	1·7	1·7	2·2	2·6	2·4	3·7	3·3	4·4	31·9
Monthly total of RAINY DAYS	21	17	18	15	13	13	15	16	15	21	20	23	207
Wind rose showing percentage frequency of WIND DIRECTION and CALMS	9 13 7 **18** *1* 11 17 10 14	8 13 10 **17** *1* 12 15 10 14	13 14 12 **17** *1* 13 14 6 10	13 **16** 13 15 *1* 15 11 6 10	13 14 11 13 *2* **15** 12 8 12	14 **17** 10 15 *2* 12 13 7 10	13 20 7 **21** *3* 7 16 4 9	10 17 6 **22** *3* 8 17 6 11	11 **15** 10 14 *3* 14 12 10 11	12 14 10 **15** *2* 12 12 11 12	10 15 9 **18** *1* 11 15 8 3	8 14 7 **20** *1* 11 17 8 14	
Average no. of days with GALES	5·0	4·0	2·0	2·0	0·3	0·4	0·4	0·5	0·7	2·0	3·0	5·0	25
Average no. of days with THUNDERSTORMS	—— 1·0 ——→		←—— ·9	——→		←—— 1·9		——→	←—— 1·3		——→	←——	5·1
Average no. of days with SNOWFALL	0·8	0·8	0·9	0·2	0	0	0	0	0	0	0·2	0·2	3·1
FLOWER FARMING	start——FLOWER PICKING AND PACKING——finish				start——LIFTING BULBS——finish	start—TOP DRESSING AND MANURING BULBS—finish start—STERILIZING BULBS—finish	start——PLANTING BULBS——finish				←MAINTAIN FLOWER BEDS→		
THE BULB	←——FLOWERING——→				←——DORMANT——→						←—SHOOTING BUDDING—→		
POTATOES	PLANT LATER POTATOES				LIFT EARLY POTATOES			LIFT LATER POTATOES			PLANT EARLY POTATOES		
OATS		PLOUGH LAND		SOW OATS			←HARVEST OATS→						
ROOTS		PLOUGH LAND			SOW ROOTS	HOEING	LIFT ROOTS			TOP AND CLAMP			
BRASSICAS						PLANT KALE	PLANT CABBAGE	HOEING				LIFT KALE	
HAY				TOP DRESSING		HARVEST HAY			RARE 2nd HAY				
CATTLE	←——COWS IN AT NIGHT——→				←——COWS OUT DAY AND NIGHT——→					←COWS IN AT NIGHT→			
KITCHEN GARDEN		PREPARE SEED BEDS		←PLANT→									
TREES ETC.	LOPPING, HEDGING, DITCHING				←—CUTTING 'FENCES' AT 6-WEEK INTERVALS—→					←—LOPPING, HEDGING, DITCHING—→			
SEAWEED	←PLOUGH IN SEAWEED→									HAUL SEAWEED FROM SHORE			
HOLIDAYS											HOLIDAY MONTH		

January to March in four years out of five and very rarely lies. Thunderstorms, scourge of neighbouring Devon, are few and far between. These factors give the farmer greater freedom of choice of crop and time of planting and consequently minimize the need of set rotations. Only exposure to wind, insufficient depth of soil and insect and fungal diseases are the farm enemies. Again, the supremacy of the bulb is evident from the diagram. The subsidiary and rotation crops mainly follow the flowering season and even calving is delayed until the flowers are despatched.

The bulb is planted in July to September, according to variety and time of flowering, by hand, in rows, in well-prepared and liberally fertilized soil, oversown with grass for pasture or hay, mostly in the sheltered squares of the inner circle of the farm. The bulb shoots in November or December and the first buds of the early varieties appear, according to weather, at dates ranging from 18th December to 28th January, usually in the first or second week of January. The chosen farm, at relatively high altitude and with north-easterly slope, is 7 to 10 days later than his near neighbours, though still 10 to 14 days in advance of the mainland, a lead on which the best market price largely depends. The flowers are hand-picked in bud to prevent wind damaging the flower and are opened or ripened in metal vases in the glasshouse. As they open they are taken to the packing shed, tied in bundles of a dozen blooms, packed in boxes of a dozen and a half to two dozen bundles, and sent by steamer, or occasionally by air, to Penzance for express despatch to London and Covent Garden market. Other markets, notably Birmingham, are receiving increasing attention. Farms on the off islands have the additional job of wading horses and carts to launches to reach the steamer at St. Mary's. Thus St. David's Day, Mothering Sunday, and Easter are very special festivals to Scillonians. The earliest Scillonian flower, the *Soleil d'Or*, does not thrive on the mainland, but mainland varieties, like *Magnificent* and *King Alfred*, and even very late varieties, like *Cheerfulness*, are grown in Scilly. Tonnage figures are misleading for the smaller blooms of pre-war varieties were packed in much lighter boxes than those now used and included up to 4 dozen bundles. Similarly, market value figures tend to hide the increase in quantity of lower quality which lower prices may bring.

Ideally the bulbs remain in the ground for three years and are then lifted, sterilized and replanted either in fresh ground or in the same square after the soil has been fumigated and fertilized. Such a basic rotation may be seen in Table II, squares 160c, h and o, the bulbs being followed by potatoes and roots or oats, but the ideal rotation is hindered by other factors, especially the health of the bulb. The bulb is subject to a number of insect and fungal attacks of which eelworm is the most prevalent, resulting in reduced yield and tainted leaves and flowers. The pest's appearance is a signal for bulbs to be lifted regardless of their duration, and, as all other crops are subsidiary, a standard rotation is scarcely discernible.

The remaining crops have a threefold purpose: to use land temporarily out of bulbs, to use land which is good arable but too exposed for bulbs, to provide a subsidiary cash or subsistence crop for food or fodder. In the last category the decreasing acreage of early potatoes can be lifted when there is labour available after the flower season, and the decreasing quantity may be marketed on the mainland in the face of mainland competition. In Pembrokeshire, for instance, the farmer is attending to this crop in February or March, not in May as in the Scilly Isles. Mangolds and kale provide the bulk of the small fodder requirements and the kitchen garden of peas, beans, outdoor tomatoes and other crops are planted and maintained. The variety is amazing, from small patches of oats, rye and wheat, always harvested whole and never threshed, to experimental patches of maize and asparagus.

Apart from smallholdings, all farms carry a few Guernsey cows. On the selected farm the animals included 3 cows, 1 calf, 1 horse and about 50 poultry. The farmer must provide about twice as much milk as the islanders require in order to cater for the summer tourist, but the out-of-season surplus is not easily distributed as there is little milk traffic with the mainland. The chosen farm, like most others, formerly made cream but now sends its milk to St. Mary's dairy where cream is made on a commercial scale in Cornish fashion and the whey is distributed to piggeries.

In conclusion, Scillonian farms bear some resemblance to general western arable types, but with certain characteristics: while they are predominantly arable, have small fields, small acreage and strip cultivation, they are highly specialized, commercially successful and partially mechanized. Flowers have driven out bullock and sheep which could, given labour, be summered on grassed, uninhabited islands. Potential variety seems to contradict the specialization, but alternative crops must compete with North Africa, the Channel Isles and Cornwall. Comparative climatic uniformity can give some freedom from a set standard rotation but a full weather cycle can occur in a week, or, in terms of a local saying, "Look for six weeks weather in March." "There is always a feast or a fast in Scilly." The present times are feast days, but the fast would remove the smallholding, as elsewhere in the west, to give units of more economical size. The practice of dividing land among sons has ceased and there is a consequent population export. But this must have happened many times in Scilly; few families are of long standing and each feast and fast brings its population interchange with the mainland. Tradition therefore dies less hard in Scilly than in some other western isles.

This Changing World

EDITED BY G. J. BUTLAND

THE BIRTH OF GHANA

The birth of Ghana as an independent state and a member both of the United Nations and of the British Commonwealth is of vast importance not only in itself but as the inauguration of a new phase in the life of Africa, in which this idea is likely to spread far and wide. Until the modern inventions of railways and motor and air transport came into existence communications in Africa were specially difficult, since so many regions were climatically unsuited to the horse and even to the ass. Small groups formed units of government, as they did in Europe and North America long ago, but we had the opportunity to use the horse and, during the last three or four hundred years, some sort of passenger wagon. The small traditional units in Africa have been brought face to face with modern complexities and the new needs and wishes of their members. In the meantime, however, Europeans have come into Africa as temporary administrators and have in many parts divided the country by drawing straight lines on a map, regardless of mountains or rivers or anything else. The new government of Ghana has to face anomalies of this kind that we have unwittingly created. It will therefore be of great interest for us—and it will call for the utmost sympathy on our part—to follow the efforts that Ghana will make to try to remould our artificial units into natural ones working together and able to hold their own in dealings with us and all other peoples.

THE POPULATION OF THE SOVIET UNION

A statistical handbook (the first since 1936) of the Soviet Union, *Narodnoye Khozyaistvo SSSR, Statisticheskiy Sbornik*, published in Moscow in the summer of 1956 gives new information on Soviet population. The figures given for 1955 and 1956 are all estimates. The official estimate of total population at 200·2 million has come as a surprise to Western scholars who had expected a figure between 208 and 216 million. The official area of the Soviet Union, given as 22,403,000 sq. km., including the White Sea (90,000 sq. km.) and the Sea of Azov (40,000 sq. km.), varies from several estimates customarily accepted; the divergence is attributed to more detailed survey cover of the country.

Table I shows clearly the large increases in Soviet Central Asia and Caucasia. Population in European Russia has grown very little, while there has been an actual decline in the Ukraine, Byelorussia and Lithuania. The increase in the former Karelo-Finnish Republic through migration into the area of Slavonic workers for its growing industries has doubtless been a major factor in the reduction of status of the area from an autonomous S.S.R. and its incorporation into the dominantly Slavonic R.S.F.S.R. The surprisingly large increase in Estonia has possibly been a consequence of exploitation of the oil-shale deposits around Narva and Kokhtla-Yarve.

Table I

POPULATIONS OF THE INDIVIDUAL REPUBLICS OF THE UNION, APRIL 1956

Republic	*Area* (*thousand sq. km.*)	*Population* (*millions*)	*Percentage Growth* (1940–1956)
R.S.F.S.R.	16,901	112·6	+4·4
Ukraine	601	40·6[a]	−0·98
Byelorussia	208	8·0	−1·3
Uzbekistan	399	7·3	+15·9
Kazakhstan	2,766	8·5	+37·1
Georgia	72	4·0	+11·1
Azerbaydzhan	87	3·4	+6·25
Lithuania	65	2·7	−6·9
Moldavia	34	2·7	+4·0
Latvia	64	2·0	+5·2
Kirgizia	198	1·9	+26·6
Tadzhikstan	142	1·8	+20·0
Armenia	30	1·6	+23·0
Turkmenistan	488	1·4	+16·7
Estonia	45	1·1	+10·0
Karelo-Finnish Republic[b]	173	0·6	+20·0
Total	22,273[c]	200·2	+4·45

[a] Including Crimea Oblast.
[b] Incorporated into R.S.F.S.R. in July 1956.
[c] Excluding area of White Sea and Sea of Azov.

The proportion of urban population has risen from 17·9 per cent of the total in 1926 to 43·3 per cent in 1955. The greatest increases have been in towns with over 100,000 people and particularly in those with over 500,000. There have been considerable increases in the medium-sized industrial towns (20,000–50,000).

URBAN SETTLEMENTS (INCLUDING TOWNS)

Size	*Number* 1926	1939	1955	*Population (in millions)* 1926	1939	1955
Below 10,000	1,446 (309)	1,443 (213)	2,614 (497)	5·2 (1·7)	7·1 (1·4)	11·9 (2·7)
10– 20,000	253 (182)	466 (269)	677 (381)	3·5 (2·6)	6·5 (3·9)	9·3 (5·5)
20– 50,000	135 (127)	288 (265)	431 (404)	4·0 (3·8)	8·7 (8·2)	13·3 (12·6)
50–100,000	(60)	(94)	128 (127)	(4·1)	(6·8)	8·7 (8·6)
100–500,000	(28)	(71)	(113)	(5·4)	(14·2)	(21·4)
Over 500,000	(3)	(11)	(21)	(4·1)	(12·8)	(20·0)
Total	1,925 (709)	2,373 (923)	3,984 (1,543)	26·3 (21·7)	56·1 (47·3)	84·6 (70·8)

Figures in brackets are the numbers and populations of towns. Any urban settlement (minimum population 400 adults of whom 65 per cent must be engaged in industry) may qualify for status as a town when its population reaches 1,000 adults, 75 per cent of whom are engaged in industry.

There are no towns between Minsk (412,000) and Omsk (505,000) and there are only four towns greater in size than Novosibirsk (731,000) but less than Kiev (991,000). After Kiev the next largest is Leningrad (2·8 million) and the largest of all, Moscow (4·8 million). Although the number of towns of over 500,000 rose from 3 in 1926 to 21 in 1955, only these two have populations exceeding one million.

The list of 134 towns with over 100,000 people shows that the smallest increases have been in European Russia, where a number of towns (e.g. Odessa) have remained almost stationary since 1939 and some have even declined (e.g. Poltava, Vitebsk, Kerch). The largest increases in European Russia have been a number of the mining towns of the Donbass (e.g. Makeyevka, Gorlovka). The greatest increases have been in the Urals, Central Asia, and in Siberia where towns in the Kuzbass have shown particularly large growth. There have also been marked increases in the towns of the Volga basin which were not invaded during the war, notably Gorkiy, Kazan and Kuybyshev. In Central Asia both Frunze and Stalinabad have doubled in size, doubtless as a result of their status as capitals of Union Republics. In Western Siberia Kurgan rose from 53,000 in 1939 to 106,000 in 1956 consequent upon its development of a large agricultural engineering industry and its rise as a centre of the new wheatlands project immediately to the south of the Trans-Siberian Railway on which it is situated (see map on p. 192 of *Geography*, vol. xli, 1956). The new estimates are enlightening for Western scholars as a number of cities have been shown to be smaller than was formerly believed. Apart from the large growth of towns in the Kuzbass, growth in Central and Eastern Siberia has been smaller than other available sources have formerly indicated. Chita, the centre of a newly developing mining area in Trans-Baykalia, with a population of 162,000 is unexpectedly small: figures almost twice as great have been suggested. Irkutsk and Vladivostok are both smaller than might have been expected; in addition, their rate of increase is low—Irkutsk has grown by 29 per cent, Vladivostok by 28·5 per cent. The official figure of 731,000 for Novosibirsk dispels a belief that the town had exceeded the 1·25 million mark. The newly released figures offer no evidence to support suggestions that the important polymetal mining centre of Norilsk on the Lower Yenisey has reached a population of 125,000. Likewise there is no evidence to confirm suggestions that Korsakov (Sakhalin) and Ust-Kamchatsk have exceeded 100,000. Since 1939, eight towns of 100,000 and over have been incorporated into the U.S.S.R.: Riga (565,000), Lvov (387,000), Tallin (257,000), Vilnyus (200,000), Kaunas (195,000), Kishinev (190,000), Kaliningrad (188,000), and Chernovtsy (142,000). Vilnyus shows a slight decline on pre-war figures, but in Kaliningrad the population has fallen by 41·3 per cent. The other towns are all slightly larger than before the war.

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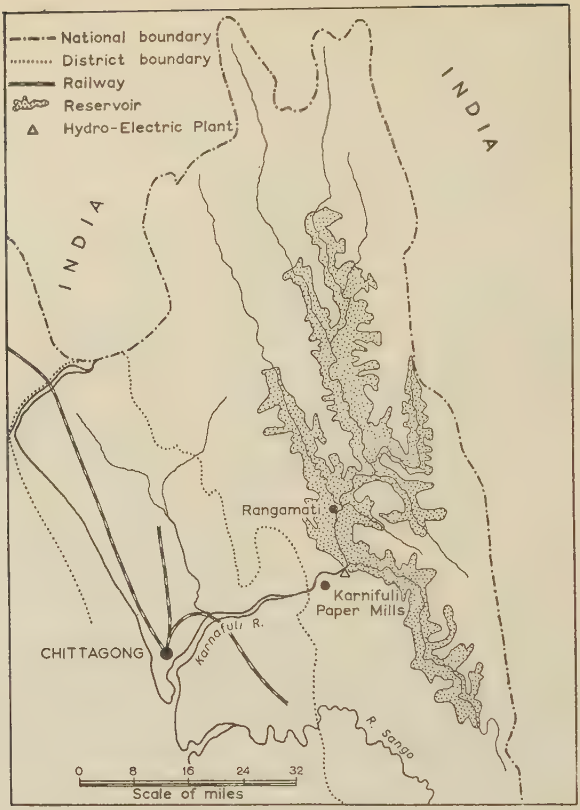
KARNAFULI HYDRO-ELECTRIC SCHEME

Lying 27 miles from Chittagong as the crow flies, this project is in an advanced stage of construction, and is expected to be finished by 1961. The Karnafuli River, here normally only 10 feet above sea level, flows in a valley 200 yards wide which has been cut into a landscape of finely dissected hills rising to over 150 feet. The river is estimated to have a maximum flow of 250,000–300,000 cusecs, and a minimum of 2,000 cusecs, a régime typical of a monsoon area. The site permits the construction of an earth dam 700 yards long and 136 feet high, which will pond up a lake having an area of 254 square miles at 120 feet above sea level. The height of the lake surface is in part determined by technical considerations, but also by the desire to restrict the ponding back of the river to Pakistan territory and to the immediate channel within India. Construction work involving much earth moving can be carried on only in the dry season as the annual rainfall of 90–100 inches is concentrated between June and September.



Initially the installation will provide a base load of 80,000 kilowatts from two generators, but eventually it is planned to install a third generator which will give an additional 40,000 kilowatts for peak loading in a grid incorporating thermal stations at Chittagong and Narayanganj. Apart from the primary aim to supply cheap power for industry and rural development in a country notably deficient in fuel resources, the dam will create some important secondary effects and some problems.

By the raising of the minimum flow of the Karnafuli below the dam to 15,000 cusecs there will be an improvement of 2 feet in the minimum depth of water available in Chittagong Port during the dry season. The greater scouring capacity of the river should also help the port as will the reduction of the silt deposition consequent on the dam's action as a settling tank. Flood control will be established in the lower Karnafuli basin. Navigation will be improved both in the river below the dam and on the lake, though the through passage of boats will not be possible, for the anticipated traffic does not justify a system of locks. A road linking the dam to Chittagong will add to the amenities of the area and may attract to the vicinity tourist traffic and industries dependent on timber supplies.

The major problem created by the dam will be that of resettling some 90,000 people whose lands will be inundated. About 80,000 of them are Chakmas, 1,000 Maghs (both hill tribes), and the remainder "immigrant" Bengalis. The tribal folk are Buddhist and more closely allied by culture to the Burmese than to the plains Bengalis; and probably 25 per cent of them support themselves by plough cultivation of rice and winter crops such as mustard, which they grow on the flat valley floors. The remainder of the tribal people practise *jhum* cultivation on the steep-sided hills which cover the larger proportion of the catchment area. *Jhuming* entails the cutting and burning of bamboo jungle, and the raising of mixed crops in the fertile ashes. At the end of the season (December) the patch is abandoned for three years or more to regenerate its fertility under a cover of bamboo. The same family may practise both plough and *jhum* farming, the former being recognized as economically more desirable, the latter as an insurance against want.

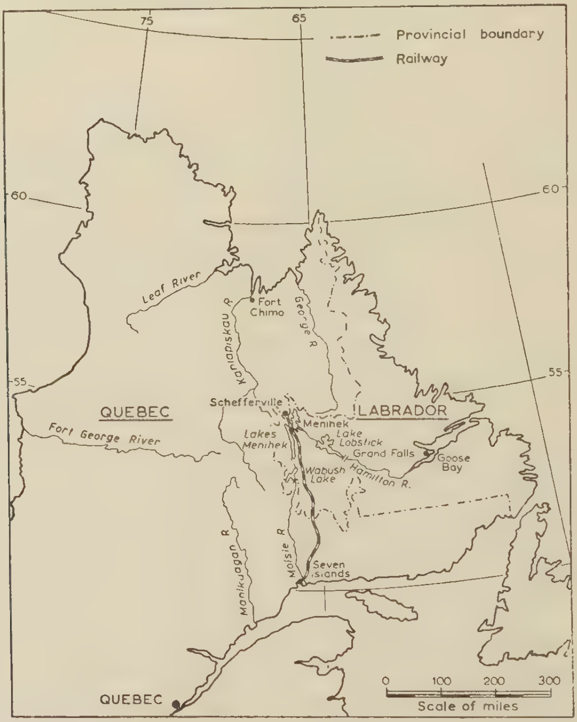
Inundation will deny to agricultural use the ploughland throughout much of the Chakma territory, and a good deal more than the area flooded will be rendered difficult of access. The Chakmas and Maghs generally live in separate villages and have little to do with one another. Intermarriage is uncommon, and a certain amount of antipathy exists. The authorities constructing the dam envisage the resettlement of the Chakmas in Magh areas lying outside the catchment area to the west, thus reducing the erosion and silting risks that would accompany their being allowed to colonize unoccupied Reserved Forest lands adjacent to their present areas. In the proposed resettlement areas however, even if land is at present available, which is by no means certain, the move would bring the different tribes into competition for a diminishing area of *jhum* and plough land, as population increases. Speedy research is urgently needed both to discover the real needs of the tribes, and to explore appropriate means of satisfying them, lest they lose faith in the authorities and decide to migrate into India or Burma, a solution which would be very damaging to Pakistan's *amour-propre*.

University of Birmingham. B. L. C. JOHNSON.

THE RAILWAY STIMULUS IN LABRADOR-UNGAVA

The Quebec North Shore and Labrador railway from Seven Islands, on the Gulf of St. Lawrence, to Schefferville, in central Labrador-Ungava, has now been in operation for over two years. Its main function is the export of the iron ore mined in the Schefferville region. Severe climatic conditions seriously affect mining activities; experience has shown that, at temperatures of around 15° F., the ore-crushing equipment at the mines functions inefficiently, and the ore freezes fast to the cars while in transit. Since these and much lower temperatures prevail in Schefferville from November to March, mining activity in this period is restricted to the stripping of overburden in preparation for the next season's production. Snowfall also gives the railway trouble. Except for June, July and August, every month has over six inches of snow. This is particularly obstructive in spring and autumn when heavy drifting is caused by high winds. In spite of these drawbacks and despite the fact that the line is single-tracked for the greater part of its length, the railway still managed to move out 12 million tons of ore in 1956. This figure will be increased to the maximum carrying capacity of 20 million tons as new mines are opened up in the future.

Hauled by huge diesel locomotives, the southbound trains often have over a hundred wagons, each holding a hundred tons of ore. In the busy season, incoming traffic consists mainly of long trains of wagons, which have been emptied quickly and turned round at Seven Islands, to keep the mines in continual operation. Two mixed goods trains a week haul in express freight and passengers, while heavy freight is brought up as train loads accumulate on the Seven Islands wharves. Such trains carry food supplies for the expanding community, equipment for the mines, fuel oil for heating and vehicles, and goods for the two local stores.



The railway has heralded an era markedly different from that which followed the steel in western Canada. In Labrador-Ungava climate and other physical conditions are such that agriculture is prohibited. Instead, railway construction has stimulated exploration for further ore bodies, and, as in other parts of the Canadian Shield, extractive industries will dominate. Plans are already being made for the exploitation of iron-ore deposits, reported to be even larger and richer than those of Schefferville, at Lake Wabush 200 miles north of Seven Islands and 30 miles west of the railway. Power for these projects will come from harnessing the high hydro-electric potentialities of the region. Schefferville is already supplied by a H.E.P. station situated 29 miles to the south at Menihek. Forty miles further south, a new road is being built by the British Newfoundland Corporation from the railway east to Grand Falls, on the Hamilton River, which are claimed to be half as high again as Niagara and to have one of the largest undeveloped hydro-electric potentials in North America.

Contrary to some modern atlases, the northern terminus of the railway is not Burnt Creek. That settlement site disappeared when quarrying began on the rich ore body which lay beneath it. The town has been re-established on the shores of Knob Lake three miles to the southeast, and has been officially renamed Schefferville after the Roman Catholic Bishop of Quebec. Although primarily an iron-mining town, it derives some importance from its position in the centre of the eastern branch of the mid-Canada defence line, a line of radar sites which is North America's second defence warning system against possible attack over the North Pole and lying roughly along parallel 55° N. From Schefferville, men and materials for construction and maintenance have been poured out in a constant stream to the sites by helicopter and conventional aircraft, work which has not only increased the volume of freight on the railway, but has more than quadrupled the number of landings on the airstrip from an average of 170 to over 850 a month.

The development of this hitherto almost unexplored region has also provided the background for McGill University to establish a sub-arctic research laboratory at Schefferville, devoted to studies in geography, botany, zoology, meteorology and seismography.

McGill Sub-Arctic Research Laboratory,
Schefferville, Quebec. GRAHAM HUMPHRYS.

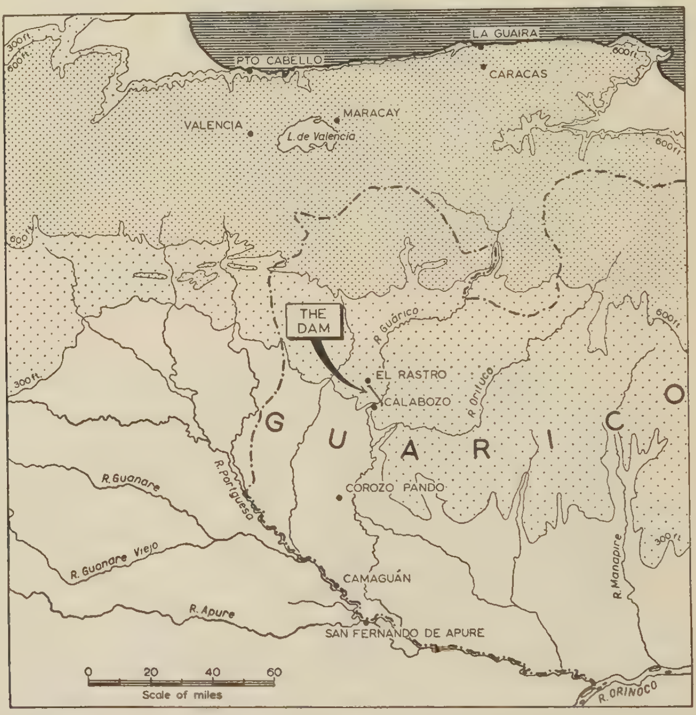
THE DEVELOPMENT OF THE VENEZUELAN LLANOS

The marked seasonal character of the rainfall experienced by the Venezuelan *llanos* has always been one of the greatest obstacles to the development of these savannah lands for cattle pastoralism. The parched pastures of the dry season from November to May give way in the wet season to a flooded countryside relieved only by island-like interfluves where the cattle take refuge until the waters subside.

A great scheme to overcome these extremes of drought and flood is now almost complete in the state of Guárico, which occupies a considerable portion of the northern half of the Orinoco basin, and if it is successful, similar schemes will follow in other parts of the *llanos*. A huge rock and earth dam, 9½ miles long, 200 yards wide and 100 feet high, has been built across the Guárico river and northwest of the town of Calabozo. As a result a lake some 90 square miles in extent and storing 500,000 million gallons of flood water will be created in a natural depression west of the river between El Rastro and Calabozo; and during the dry season the water will be released to irrigate 272,000 acres of land by means of a 300-mile network of canals and ditches as far south as Corozo Pando and Camaguán, thus increasing the area of land in Venezuela under irrigation by over 50 per cent.

The plans for this area envisage 550 ranches each of 500 acres, large enough to enable individual farmers to grow subsistence crops and to specialize in cattle-raising for beef and dairy products. By the end of 1956, 10 per cent of this area had been occupied, much of it by farmers displaced from the land used for the dam and the lake. In addition to irrigation and flood control, the project provides for integrated development of the area. There has been a complete soil survey; properties have been fenced and re-seeded with new varieties of grass; technical advice organizations have been set up to assist with pest control, fertilizers, equipment and finance; and grain-drying plants, silos, warehouses and community facilities are being provided in convenient urban centres. The total cost of the development scheme will exceed £16 million.

The accessibility of Guárico state to the major national markets of Valencia, Maracay and Carácas, all less than 200 miles distant and connected by good motor roads, was an important factor in the choice of this region for the scheme, but, with its 7 million acres of pastures and nearly 1 million cattle, the state has been the home of the Venezuelan *llanero*, or cowboy, for over four centuries.



Other methods for improving the stock and the stock-capacity of these tropical pastoral lands are also being undertaken. In recent years hundreds of artesian wells have been drilled and ponds constructed in natural depressions to hold sufficient water for the dry season. Simultaneously, since 1954 more than 4,000 pedigree cattle (Zebu, Brahman, Santa Gertrudis, Swiss Brown and Holstein) have been imported, mainly from Texas, to improve the quality of the *llanos* herds.

University of Birmingham. GILBERT J. BUTLAND.

COMBATING THE RABBIT PEST IN NEW ZEALAND

The drastic effects of myxomatosis on the rabbit populations of Britain and Australia have been widely publicized. Little has been heard of an equally successful campaign waged in New Zealand in recent years without the benefits of "germ warfare." Attempts to introduce myxomatosis into

New Zealand have failed for want of a suitable vector; neither the rabbit flea, that spreads the disease in Britain, nor the species of mosquito that is the vector in Australia, is found in the Dominion. The recent success of the "conventional" weapons (carrots-and-arsenic, phosphorized pollard, cyanide fumigators, guns, dogs and traps) is the more remarkable in that they have all been used for many years.

Rabbits were introduced into New Zealand as early as 1838, but it was not until about 1870 that their numbers began to cause concern. They first became a problem in Otago and Marlborough and spread from there into Canterbury. From the 1850's onwards, the native tussock grasslands of these provinces had been grazed by sheep and burnt to promote new growth. Depletion of the plant cover bared the dry, friable soils and provided ideal conditions for rabbits liberated by gold prospectors and misguided sportsmen. Where the rabbits thrived, sheep starved; in the economic depression of the 1880's, many sheep-farmers were ruined by the cost of the battle against the invading rabbits. Of the many and varied control measures tried, poisoning and trapping became popular because they yielded a return from the sale of skins, the export of which became an important item in New Zealand's trade (see Table I), though it is doubtful if the value of the skins ever equalled the lost income from the sheep displaced by the rabbits killed. The loss of income from sheep displaced by rabbits *not* killed may well have run into millions of pounds a year.

Table I

Average Annual Export of Rabbit-skins from New Zealand

Period	*Skins* (*thousands*)	*£NZ* (*thousands*)	*Period*	*Skins* (*thousands*)	*£NZ* (*thousands*)
1873–80	2,284	17	1921–30	14,229	567
1881–90	10,357	94	1931–40	11,063	329
1891–1900	11,596	85	1941–50	13,503	882
1901–10	6,904	65	1951–55	2,523	37
1911–20	8,076	247			

The figures suggest that some measure of control had been achieved in the years just before World War I, only to be lost again for want of labour during the war. A similar upsurge in rabbit numbers occurred during the last war. A survey carried out in 1946–8 showed heavy infestations in most areas of low rainfall and friable, well-drained soils, notably parts of Hawke's Bay, Marlborough, North and South Canterbury, Central Otago and Southland. Rabbits were not common in areas of intensive pastoral farming, where lush pastures and a moderate or heavy rainfall made conditions too wet for their liking. The rabbits had, it seemed, colonized almost every area suitable to them. In the more heavily infested districts, they were a contributory cause of soil erosion and a major obstacle to any schemes for re-grassing depleted or eroded land.

Experience seemed to show that no campaign against the rabbit would succeed until "rabbit-farming" was made unprofitable. As long as the rabbit had any commercial value, it would never be deliberately exterminated by those who could expect to make a living from the progeny of a few survivors. As a first step towards "devaluing" the rabbit, the Rabbit Nuisance Amendment Act, 1947, introduced a levy on skins exported. This was

10 per cent of their value at first, but was raised progressively to 66⅔ per cent. In 1954, the export of rabbit carcasses was prohibited.

The 1947 Act also provided for a campaign of extermination to replace "private enterprise" killing. A Rabbit Destruction Council was established to supervise the work of local Rabbit Boards and to make grants to boards needing funds in excess of their income from rates and the Government's subsidy (£1 for £1). The skin export levy was paid into the Council's funds, but as this soon ceased to yield a useful income, large sums have had to be provided by the Government. The total annual cost of rabbit destruction in recent years has been about £1,100,000.

The effects of the devaluation policy have been reinforced since 1950 by high wool prices, which have increased the incentive to farmers to clear their land of rabbits in order to grow more wool. The initiative in forming Rabbit Districts rests with the farmers; their response is seen in the increase in the number of districts from 108 in 1948 to 196 in 1956. The area covered has increased from 18 million to 29 million acres. The greatest gains have been made in the South Island, especially in Central Otago and South Canterbury. All Rabbit Boards have been encouraged by the Council to adopt a "killer policy," under which the board engages rabbiters, supervises their work and sells any skins recovered. The work of destruction goes on throughout the year, in contrast to private enterprise killing, which was largely confined to the winter months.

The results are impressive. The areas within Rabbit Districts classed as "heavily infested" totalled 4,235,000 acres in 1948: in 1955 they amounted to only 375,000 acres, and over half the total area was classed as "clear or odd scattered rabbits." The number of skins exported fell from 13,471,298 in 1948 to 662,238 in 1955. The benefits to sheep-farming are not so easily measured but many farms cleared of rabbits are carrying more sheep and shearing more wool per sheep. On ploughable land, cultivation and reseeding can quickly restore pastures once the rabbits have gone, but on steep country natural recovery may take some time. Here, farmers are wisely refraining from increasing the size of their flocks, but are already enjoying heavier wool-clips and improved lambing rates. A recent survey of Central Otago speaks of "a new cycle of plant cover from spring onwards—the 'green tinge,' where before no species could survive the close grazing of the rabbits."

If the ground won is to be held there must be no slackening of the campaign. The survivors must be allowed no respite, even though, in areas where the annual kill now averages less than one rabbit per hundred acres, few rabbits are seen in daylight. As the cost of operations is now high in terms of rabbits killed, there is a danger that a false sense of security may lead to economies and relaxed vigilance. There are still a few infested areas without Rabbit Boards, where some of the farmers cater for the local market in rabbit meat. The Rabbit Destruction Council is urging the Government to bring all infested areas under board control and to suppress the carcass trade. "Rabbit meat," it declares, "is of very low nutritional value and . . . frequently as dear . . . as the best cuts of beef." Real security for New Zealand's farmlands will come only with the complete eradication of the rabbit pest, and the Council is aiming at nothing less.

University of Manchester. J. S. Duncan.

Obituary

EMERITUS PROFESSOR R. N. RUDMOSE BROWN

Dr. Robert Neal Rudmose Brown died on 27th January in his seventy-eighth year. By training a botanist with a strong inclination for field study, he was appointed assistant professor of botany in University College, Dundee, from 1900 to 1902. During the earlier years of his career he was much influenced by the thought and teaching of Patrick Geddes and by some of the pioneer teachers of geography during the critical period of the subject's emergence at the beginning of the century. In addition, from 1902–7 he travelled widely as explorer, naturalist and surveyor in the unexplored Antarctic seas with the Scottish National Antarctic Expedition, or reporting on the pearl fisheries of Burma for the Indian Government. When in 1908 the University of Sheffield took, for that time, the very progressive step of creating a Department of Geography, Rudmose Brown was appointed its first head, and the development of the new subject and the new Department became his life's work. He will always be remembered as one of the leading pioneer teachers of our subject and one who did much to promote the status of geography as an academic discipline in Britain. He placed great emphasis on the importance of the physical basis as the foundation and core of the subject, and this approach at that time gave the work of his Department at Sheffield a distinctive character. On the creation of a chair of geography at Sheffield in 1931, Rudmose Brown was appointed professor; he retired in 1945 after thirty-seven years of service.

Throughout his career his interest in polar regions never waned; he took part in three Scottish expeditions to Arctic regions (in 1909, 1912 and 1919) and became an acknowledged authority on Spitzbergen. His published researches were mainly concerned with polar geography, but his scholarship and interests covered many fields, and included a textbook of economic geography widely used. He was a gifted teacher, much interested in the problems of the teaching of the subject, as was evident in his joint authorship with O. J. R. Howarth and J. McFarlane of *The Scope of School Geography*, a manual on the study and teaching of the subject first published in 1922. Time and again his former students have paid tribute to his gifts of exposition and to the abiding love of the subject which his teaching stimulated in a remarkable degree.

Rudmose Brown's scholarship brought recognition in many spheres. For his work as a naturalist and explorer he was awarded a medal of the Royal Scottish Geographical Society and the Cuthbert Peak Grant of the Royal Geographical Society, and he was a president of both the Arctic and Antarctic Clubs; he was president of Section E of the British Association for the Advancement of Science in 1927 and a member of its Council from 1933 to 1938; he served for some years as a member of the Council of the Royal Geographical Society and in 1938 and 1939 was elected president of the Institute of British Geographers, the second holder of this important office. He directed the Spring Conference of the Geographical Association when first held in Sheffield in 1936, and was for many years president of the Sheffield Branch, whose field activities he fostered in an era when field study had hardly emerged as an essential part of our subject. ALICE GARNETT.

Geographical Association

SUMMER SCHOOL IN HISTORICAL GEOGRAPHY

We are grateful to the University of Birmingham for taking over the organization of the Summer School in Historical Geography to be held at Barford, Warwickshire, under the leadership of Dr. H. Thorpe from 3rd to 17th August 1957. The financial guarantees which can in these circumstances be made have permitted a reduction in the fees for the course, for which programme-leaflets were circulated with the January issue of *Geography*. Late inquiries should be addressed to the Principal, Westham House, Barford, near Warwick.

ANNUAL CONFERENCE 1958

The Annual Conference of the Association will be held at the London School of Economics from 31st December 1957 to 3rd January 1958. The usual facilities for the accommodation of members at Campbell Hall will be available and information about reservations will be circulated with the Conference programme to all members in November next.

GEOGRAPHY ROOM SURVEY

The Secondary Schools Section Committee reports a good response to the questionnaire on the geography room survey circulated earlier this year, and thanks all the members who co-operated in this inquiry by returning the completed questionnaire, often with their comments on experience of the provision of geography teaching rooms. The answers on the questionnaires returned have been analysed and it is expected that a report on the survey will be published shortly in *Geography*.

BRANCH NEWS

It is with the greatest pleasure that we report the revival of branch activities in Newcastle-on-Tyne, under the enthusiastic guidance of Mr. F. A. Arrowsmith and Mr. S. L. Hockey. We are grateful for the help and support given by the Department of Geography of King's College, University of Durham.

Inquiries about the branch programme and membership should be addressed to Mr. S. L. Hockey, Department of Education, 12 Leazes Terrace, Newcastle-on-Tyne.

O.S. MAP EXTRACT SETS

Supplies of the sets of 6 O.S. map extracts offered by the Association are now exhausted, but some quantities of individual sheets are available for sale at 9d. per sheet. The extracts offered, all on the scale of one inch to a mile, are: Cairngorms; South Wales Valleys; Mid Severn Valley (and water and contour sheets to accompany); and a few South Downs sheets. Geological transparencies are available for South Downs and South Wales Valleys.

The Standing Committee for Visual Aids is already working in collaboration with other committees on the preparation and planning of new sets of teaching map extracts.

CORRECTION

A correction should be made to the caption of Fig. 1b in "Vegetable Oils and Oilseeds" by A. B. Mountjoy in *Geography*, vol. xlii, January 1957, p. 40. It should read "Annual oil consumption *per head* in Great Britain 1934–8 (average) and 1953."

BACK ISSUES OF *Geography*

Early parts of the *Geographical Teacher* and *Geography* up to vol. 14, 1927–8, either in complete sets or in partial runs, will be gladly accepted at headquarters. Other back issues of which copies are urgently required for libraries and other collections are:

Vol. 25, 1940, part 4
Vol. 29, 1944, part 4
Vol. 30, 1945, parts 1, 2, 3 and 4
Vol. 31, 1946, parts 1, 3 and 4
Vol. 32, 1947, part 1
Vol. 34, 1949, part 3

Vol. 35, 1950, part 2
Vol. 36, 1951, part 4
Vol. 37, 1952, part 3
Vol. 38, 1953, part 4
Vol. 39, 1954, part 1
Vol. 41, 1956, parts 1 and 3

We shall be grateful for spare and unwanted copies of these, which should be sent to the Assistant Secretary at headquarters office.

REPRINTS

The following new reprints are available from headquarters office: "The Sussex Rivers" by D. L. Linton (read at the Spring Conference in Brighton, 1956), *Geography*, vol. xli, November 1956. 2s.

"Studies in the Geography of the South West Peninsula": papers read at the Spring Conference at Exeter, 1954, *Geography*, vol. xxxix, November 1954. This is a second reprint, at special request; the authors are Professor S. W. Wooldridge, Professor A. Davies and Dr. A. H. Shorter. Price 2s.

THE ASSOCIATION'S LIBRARY

Recent changes in staff assistants have at times delayed the handling of members' requests for book loans, titles or reference lists, while the withdrawal of some postal collection facilities have burdened our young assistants with heavy duties in the despatch of books by post. The training of a new library assistant is now being undertaken and it is expected that a smooth and speedy loan service will be restored very quickly.

The second part of the printed catalogue is now available; this covers the library section on *Africa* and is a valuable classified reference on literature for that continent. The catalogue carries a simple map to show at a glance the classified divisions applied in our library. The sale price of the catalogue is 2s. to members (3s. to non-members). Copies of the *Asia* catalogue can be supplied at 2s. 6d. each (3s. 6d. to non-members). Standing orders for the supply of the catalogue parts as they are published can still be accepted, and indeed this method of obtaining the catalogue is recommended, to ensure a complete set for binding together on completion of the printing. Supplementary lists, in a format which will be easily adaptable to the existing catalogues, will be issued from time to time.

Information now available in leaflet form to members includes a brief description of the classification used in the Association's library; this is a modification of the classification described in the *Annals of the Association of American Geographers*, vol. xxvii, 1937, and is especially useful for collections of geographical texts. We have also printed a list of the geographical and other periodicals received in the library, showing the length of run which we hold and the sources of the periodicals. Both of these leaflets will be supplied free on receipt at headquarters of a request stating the member's name and address and enclosing 3d. in stamps. Envelopes should not be sent.

VISUAL AIDS CATALOGUES

The Educational Foundation for Visual Aids has published two revised and enlarged catalogues as parts III (Geography—General, physical and economic) and IV (Geography—Regional) of its series *Visual Aids: Films and Filmstrips*. These most useful booklets list films and filmstrips in a classified fashion, stating the age groups for which each film or strip may be used (including both primary and secondary groups), prices, hire charges and information on ordering for purchase, loan or preview. They cost 3s. each (including postage) and can be obtained from the Foundation at 33 Queen Anne Street, London, W.1.

INFORMATION ON AUSTRALIA

By a special arrangement with the Librarian of Australia House, London, to whom we are most grateful, the Association's library now receives the parts of the Year Book of the Commonwealth of Australia as they are issued throughout the year by the Commonwealth Bureau of Census and Statistics. The Year Book covers—I: Discovery, physiography, government and land tenure; II: Territories of Australia; III: Labour, wages and prices; IV: Trade, transport and communication; V: Manufacturing, electric power, water conservation; VI: Education, justice, health and welfare services; VII: Population and vital statistics; VIII: Finance and local government; IX: Primary production; X: Defence, repatriation, principal events, miscellaneous; XI: Appendix and indexes. The separate parts may be borrowed from the library by members of the Association in the British Isles.

Other Australian government publications can be consulted in the library at Australia House, and many can be obtained by teachers direct from the Government Printer, Canberra; or, in the case of a few limited numbers of papers for free distribution, from the Commonwealth Statistician, Canberra. Examples of purchasable publications are *Quarterly Summary of Australian Statistics* (12s. 4d. per year, including postage); *Annual Statistical Reports: Demography* (9s. 3d.); *The Australian Mineral Industry* (Quarterly review of statistics, 3s. per part).

An article on sources of material for the teaching of Australian geography by B. H. Farrell was published in the *Journal of Geography*, vol. lv, December 1956.

FARMING FACTS

A mimeographed monthly bulletin of this title is published on behalf of the Association of Agriculture, aimed primarily at the adult urban population. Much of the statistical and abstract information on agriculture in Great Britain which the bulletin supplies could be used in schools both in advanced level studies and for material for lower school projects. Specimen copies may be obtained from the Graham Cherry Organization, Eagle House, Jermyn Street, London, S.W.1.

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Details of fees, together with prospectus and application forms, can be obtained from:

The Deputy Director (ExG.), Department of Extra-Mural Studies,
University of London, Senate House, W.C.1.

Reviews of Books

With very rare exceptions, books reviewed in this journal may be borrowed from the Library by full members or student library members of the Association.

Physical Geography. T. Pickles. 13 × 18·5 cm. xi + 145 pp. London: J. M. Dent and Sons Ltd. 1956. 5s.

This is a recent addition to a well-known series of textbooks intended for grammar school pupils preparing for G.C.E. at Ordinary Level. Drawing on his wide experience the author makes a plea for the inclusion of physical geography as an entity in the school course and argues cogently that the evocation of a sense of wonder will stimulate interest in this branch of the subject which will last beyond the requirements of the examination. In the main he succeeds in his aim. The choice of material follows the usual range for a book at this stage. There are chapters on the formation of the earth, types of rocks, land forms, vulcanicity, agents of erosion and the oceans, in which clear, vivid writing is made more effective by the introduction of interesting specific examples drawn mainly from the British Isles. A large number of block diagrams and maps increases the value of the book. The last chapter on Weather and Climate seems to be too condensed for complete success and the climate of North Island, New Zealand is not typical of the mediterranean type.

Inevitably in this short compass there is a tendency to over-simplification, but those teachers who wish to give special attention to physical geography will find the book very helpful. D. W. S.

An Introduction to the Study of Map Projections. J. A. Steers. 10th edition. 14 × 22 cm. xxviii + 324 pp. London: University of London Press. 1956. 20s.

This continues to be the standard text for introducing the study of map projections and particularly the understanding of their practical construction. The tenth edition has a few extra pages of notes on new developments, including two additional diagrams. Hammer's name at last supplants Aitoff on that well-known projection.

While this edition is still a most useful handbook, the method of keeping it up to date by adding notes is reaching its limit and we may hope that soon Professor Steers will be able to recast it entirely, giving more prominence to projections used in modern practice and in particular to the conventional and arbitrary projections. The simple classic projections should, no doubt, remain on the grounds that they are essential for a basic understanding of the subject, but there should be more indication of the relative frequency of use of projections and of the actual numerical values of errors involved. R. M.

Things Maps Don't Tell Us. A. K. Lobeck. 19·5 × 27·5 cm. x + 159 pp. New York and London: The Macmillan Company. 1956. 34s. 6d.

The sub-title of this book is *An Adventure into Map Interpretation.* The field of adventure includes the school atlas and the motorist's map; the author, in preparing a book for the general reader, has deliberately avoided the use of large-scale topographic maps. Of the 72 examples, 71 refer to physical features and 48 of these to coastlines, islands or lakes. The emphasis throughout is on the physical pattern as seen in plan. Professor Lobeck has ranged widely over the world for his subjects, although it is natural that more than half should be taken from the U.S.A. Some questions—for instance those concerning the shape of the Mediterranean, and the pattern of the Mississippi system—are broadly framed; others, such as the radial drainage of Mount Rainier and the falls of the Yosemite valley, relate to single features. The influences of structure, lithology, erosion and deposition are all considered.

The style of treatment is one that might have been expected from the author of the familiar *Geomorphology*. Each problem is set by maps printed on a left-hand page; the explanation is given on the right. The lavish illustration provides many examples of the graphical style well suited for use by school pupils and college students. Some readers may object to the old-fashioned hachuring used in places as strongly as they may approve of the illuminating drawings in, for instance, examples 13, 17, 25 and 46. Teachers in Britain will doubtless notice that in example 14 the two areas where Cretaceous rocks overstep the Jurassic system are not represented, and that no Chalk is shown in the Isle of Purbeck. On p. 139 the Zuider Zee is ascribed to the outbuilding of the Rhine delta instead of to subsidence; and on p. 153 the author mistakes the meaning of the word *côte* and ignores its relation to *cuesta*. A number of the maps have no scale.

The table of contents with its explanatory headings, the five pages of index and the lay-out make reference to the book easy; the phrasing of the text is very simple throughout. Even those who do not require the explanations and who are familiar with many of the examples should find material which is new and striking.

G. H. D.

Map and Photo Reading. T. W. Birch. 18·5 × 25 cm. 64 pp. London: Edward Arnold Ltd. 1956. 16s.

Experienced teachers have usually worked out a course of map reading for their pupils; they may use a map-reading book or they may prefer to use the set of maps prepared by the Geographical Association some years ago. For those in their first grammar school post or in a training college *Map and Photo Reading* (and the accompanying answer book) is highly recommended. This book, consisting of a graded course of map-reading, is planned to cover four years, the grades corresponding to forms in a secondary school. The author suggests that "the ragged periods" at the beginning and end of terms might be used for this work and students are expected to answer all the questions of one grade, i.e. about eight sets of questions per term out of the 24 for that year.

Not only are various scales used, from the 25-inch to the One-inch O.S., but different editions are referred to. Photographs taken from the air and on the ground are interpreted in conjunction with the maps, which were selected for their variety of land form and land use. They include Plymouth, rural Worcestershire, Folkestone and the Downs, Cardiff and Cefn Coed Colliery, the Highlands of Scotland, part of the Fens, Ingleton and the coast of North Devon. There are also suggestions for model-making, reducing and enlarging scales, section-drawing, writing descriptions of walks or views and map-drawing from topographical descriptions.

Considering the excellent reproduction of maps and photos the price of the book is not unreasonable, but some schools may not be able to consider a class set of 35 books for map reading alone at 16s. per head.

E. M. C.

General World and Regional Geography. A Revision Course. J. S. Hobbs. 14 × 22 cm. 286 pp. London: English Universities Press Ltd. 1956. 12s. 6d.

This, the last of a series of five books, is intended for use in the final year of the G.C.E. course at Ordinary Level. It aims to revise four branches of geography—

map work, local geography, general world geography and regional geography. The first two divisions are combined in one chapter, and although the pupil is urged to use local Ordnance Survey maps in and out of the classroom, the emphasis inevitably falls on map work, liberally interpreted. General world geography occupies about 30 per cent of the book, regional geography about 62 per cent. The general sections include material on physical geography, geographical environments and the distribution of the world population. The regional chapters deal, in decreasing order of detailed treatment, with the British Isles, Europe, the U.S.S.R., North America and Asia. A final chapter of four pages covers the southern continents.

The method of approach throughout the book is epitomized by the second sentence of chapter 7: "A thorough knowledge of the regions of the world provides a very useful background for a more detailed study of the continents." The particular follows the general. For those who prefer this method the book provides a great deal of information, generally sound and up to date. The lay-out, with its occasional use of heavy type and pages of nearly 600 words, is rather formidable; so much is packed in that facts often receive little elaboration and tabular summaries occur frequently. Sketch maps and pictures are clear and well-chosen and there is a useful index. The book is admirably designed to provide the answers to the questions examiners set; it would be of value to the bright pupil who can work on his own.

D. W. S.

Economic Geography. R. Hope. 14 × 22 cm. xii + 292 pp. London: George Philip and Son Ltd. 1956. 15s.

Introductory Economic Geography. L. E. Klimm, O. P. Starkey, J. A. Russell and J. R. Whitaker (gen. editor). 17·5 × 24·5 cm. xx + 730 pp. New York: Harcourt, Brace and Company. 1956. $7.50.

These two books are further additions to the rapidly growing list of publications which fail to justify the titles under which they are written. Professor Wooldridge long ago raised a plea for "an economic geography worthy of the name"; but it is a cry which has evoked little significant response from these nomadic compilers who are trying to raise their stock in an arid waste of commercial fact. The mere reshuffling of the sequence of chapters, patterned in the pre-war years by pioneers such as Stamp and Jones and Darkenwald, achieves nothing but the perpetuation of inadequacies.

Hope's book has the makings of a useful Sixth Form text if, by careful revision, the inaccuracies and half-truths too numerous to detail can be removed. As it stands, the book is a study in conflicts. The factual errors are offset by a fund of interesting detail; well-chosen photographs are badly reproduced; poorly selected maps are well drawn; and a text oriented for the Sixth Form is littered with bar graphs, flow charts and pen sketches ranging from hemlock to sea lions which would hardly raise a third former's enthusiasm.

The American compilation is, of course, aimed at the American market and, in consequence, falls into no particular area of use as a textbook in this country. It is a work which has cast its net widely to catch anything even remotely concerned with commercial geography and it reaps a demersal harvest—too shallow, in other words, for university work, except perhaps where it deals specifically with the United States. In detail, it is refreshing in stressing the map as "the fundamental geographic tool" though it is a pity it has to spoil a good selection of maps by many attempts to give a visual impression of relief and by printing world distribution maps only to half-page size. Photographs and general quality of production are excellent. Its price alone condemns it as a Sixth Form text, even if the scanty treatment given to regions outside the U.S. could be tolerated. A wealthy school library might find it useful as an additional reference book.

A. C. W.

A World Geography of Forest Resources. American Geographical Society Special Publication No. 33, edited by S. Haden-Guest, J. K. Wright and E. M. Teclaff. 17 × 25·5 cm. xviii + 736 pp. New York: The Ronald Press Company. 1956. $12.50.

This is a new standard work of reference consisting of 31 separate contributions carefully edited by the American Geographical Society. It replaces the two-volume work entitled *Forest Resources of the World* by Raphael Zon (who is a contributor to the new work) and W. H. Sparhawk, which was issued in 1923, and has since been almost the only reference book covering the whole world. There is an introductory section of five papers dealing with the general position. One is particularly important in that it corrects much nonsense which is both written and talked regarding the effect (very slight) of afforestation on rainfall. The bulk of the book is a regional treatment, about half by native experts on their own countries, about half by American authors. Unfortunately the section on the British Isles is one of the poorest—with no bibliography—though it does include some out of the way information on famous or outstanding trees and the royal forests. Teachers will appreciate the pictorial atlas of over 100 excellent photographs of forest types from all over the world, and a very full list of local and botanical names of trees. Writers of travel books, which may be used as background reading, so often use local names which vary, for the same tree or type of forest, from one country to its neighbour that this section is very helpful. Some countries (Alaska, Canada, United States, Pakistan, India, Australia and New Zealand) are treated separately; in other cases the treatment is regional (Mediterranean region, South America, tropical Africa, southeast Asia) and in most cases there are maps, diagrams, statistical details and references. Teachers ought particularly to be aware of current views—such as the origin of most "savanna" from light tropical forest by the agencies of fire and grazing—and these are objectively discussed in this fine book. It should be on the reference shelves of every school library which can afford it. L. D. S.

An Introduction to the Botany of Tropical Crops. L. S. Cobley. 14 × 22 cm. xv + 357 pp. London: Longmans, Green and Co. Ltd. 1956. 37s. 6d.

This book is designed for agricultural students, and its twelve chapters include accounts of nearly all the tropical plants known to commerce and of those which are of importance to native peoples. Its value to geographers will mainly be to supply ancillary details, especially in its detailed plant descriptions and the lists of the various uses to which different parts of the plants are put.

The geographical matter is meagre. There are no maps of any kind, while regional production is normally limited to a list of producing countries or even regions (West Africa, Central America, etc.). There are no statistics, and there is no indication of changing patterns of production. Climatic influences are mentioned only in the most general terms, and temperature and rainfall figures are very sparingly used. Related social and economic topics are ignored or dismissed in a few lines. Little recognition is accorded to present-day difficulties, trends, or research—even in what might be regarded as botanical matters; for instance, small mention is made of the importance of hybrids in various fields, while the question of disease is barely mentioned. Swollen shoot, for example, is mentioned, but the other dangerous diseases of black pod and the menace of the capsid bug to cocoa production are not recorded.

The plant descriptions take up the greater part of the book, and the diagrams and photographs are most useful. Most geographers will learn something fresh about the various uses to which plants are put. From these points of view the book must commend itself as a reference book in school and college libraries.

H. R. J.

Times and Places. The Corridors of Time, Volume X. H. Peake and H. J. Fleure. 14 × 20·5 cm. xv + 336 pp. Oxford: Clarendon Press. 1956. 42s.

This book is planned as a conclusion to the series *The Corridors of Time* and has been completed by the surviving author of the earlier volumes, Professor H. J. Fleure. Very naturally, therefore, the volume begins with an affectionate and vivid picture of H. J. E. Peake, an appreciation of that learned and distinguished gentleman. The fact that a book of this size, bringing much of the work in the previous volumes up to date, could have been published by Professor Fleure ten years after Mr. Peake's death in 1946 is in itself a triumph of scholarship and devotion to the cause of learning, so typical of the author.

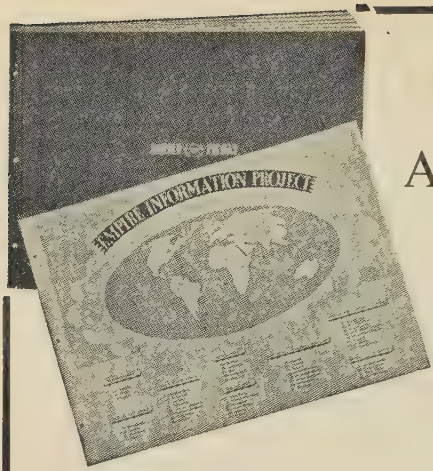
The book is arranged in two parts. The first attempts a broad sketch of modern thought and scholarship relating to the Old Stone Age. The second part discusses the diffusion of the arts of civilization, particularly those of food production by cultivation and the domestication of animals from southwest Asia and Egypt into a number of regions, and then follows life in those regions in very broad outline from that beginning. It might be said at once that the scheme as developed is eminently successful.

The only question that arises in the minds of teachers is whether the final volume should be conceived in this manner or whether it should continue the story down the Corridors of Time from where the previous volume, *Law and the Prophets*, left off. Many students would have liked to have read Professor Fleure's mature views on the later history of mankind leading up to these days of the unification of the world on the basis of communications. This, after all, is where the long corridors through which we have been so well conducted by Messrs. Peake and Fleure have led us. Does the surviving author think the tour has been worthwhile and that it helps us to understand the vista we see at the end of the corridors? What happens next? Nevertheless, Professor Fleure's stimulating volume may help many to think anew of Man's efforts in *times* gone by and of his achievements in many *places*. E. G. B.

New Zealand Geomorphology. Reprints of Selected Papers 1912–1925. C. A. Cotton. 14 × 22 cm. 281 pp. Wellington: New Zealand University Press. 1955. 50s.

For variety of geomorphology in relatively small space New Zealand is unrivalled. It has rocks of all ages and types, fold, block and volcanic structures, climates (and therefore weathering processes) varying from humid sub-tropical to glacial and near arid, glaciers and snowfields and a long coastline showing nearly every shoreline type. Moreover the islands have experienced, and in fact are still feeling, changes of level both eustatic and isostatic, presenting some pretty problems in the piecing together of erosional history, various cycles having been interrupted at different stages in their evolution. In most cases the proximity of the coast aids the solution by permitting a neat correlation between inland and coastal forms. Dissection of peneplains can be linked with raised beaches and terraces, aggraded valleys and basins with drowned inlets, and so on.

Into this rich mixture Professor Cotton has been dipping for forty-five years and pulling out plum after plum, presenting them in a long series of papers, clearly written in simple language unobscured by any pretension to literary style and illustrating them with block diagrams which are strictly functional, without any concession to artistic effect. At first sight these appear too schematic to be true, but the morphological features are equally clearly revealed in the 16 half-page plates at the end of the book, many of them low-angle oblique air photos; it is clear that much of New Zealand's geomorphology *is* schematic and for this reason affords magnificent teaching material. For anyone who has hitherto studied land forms in a stable region like Britain there is the exciting novelty of introduction to a



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"mobile belt" where fault-scarps, fault coasts and even actual earthquake "rents" produced by historic earthquakes are still to be seen as fresh features in the landscape.

The sixteen selected papers, written between 1912 and 1925, that are reprinted in this book are mostly concerned with the evolution of relief in block structure. Professor Cotton shows that the effects of the Mesozoic folding, formerly thought to be dominant, are much less effective in shaping the relief of New Zealand than the later Kaikoura (late Tertiary) orogeny that dislocated those early folds, together with the Cretaceous cover that had buried their eroded edges, and produced a "basin-range" physiography. A faithful disciple of W. M. Davis, Professor Cotton analyses his land forms in terms of Structure, Process and Stage, regarding each cycle of erosion as reborn with each successive deformation or change of level. It would be interesting to see how Penck's views could be applied in a country where crustal deformation and changes of level are actively going on at the present day, but the only mention of the *Morphologische Analyse* is in a footnote added after the English translation had appeared.

For Professor Cotton geomorphology is a study complete and satisfying in itself; it is a branch of geology and it is no concern of his what man does to the landscape or, except for a rather macabre inquiry "For how long will Wellington escape destruction by earthquake?", how geomorphology affects man's occupance. No better or clearer guide could be found to the suite of landscape described in this book; for the great variety of other forms so richly represented in New Zealand the reader will go with expectations to the author's trilogy of landscape books, *Normal Erosion, Climatic Accidents* and *Volcanoes.* A. A. M.

Geographical Articles

Listed from Periodicals received in the Library

CONTINUED FROM VOL. XLI, PP. 216 TO 218.

Journals listed here may be borrowed from the Library by members of the Association. References are listed according to the classification published in the *Annals of the Association of American Geographers*, vol. xxvii, June 1937. Authors' reprints presented to the Library are included in the list of articles.

A of G—Annals of the Association of American Geographers. A of Sc—Advancement of Science. EG—Economic Geography. EMG—East Midland Geographer. FO—Focus. GA—Geografiska Annaler. GB—Geographical Bulletin, Canada. GJ—Geographical Journal. GR—Geographical Review. GRI—Geographical Review of India. GS—Geographical Studies. GT—Geographisch Tijdschrift (Netherlands). IGJ—Indian Geographical Journal. J of G—Journal of Geography. NG—New Zealand Geographer. PG—Przeglad Geograficzny (Poland). PGA—Proc. of the Geologists' Association. PRST—Papers and Proceedings of the Royal Society of Tasmania. RCG—Revue Canadienne de Géographie. RGL—Revue de Géographie de Lyon. SGM—Scottish Geographical Magazine. UE—United Empire.
*—Map.

GENERAL GEOGRAPHY. A of Sc, Mar. '56.—Report of geographical glossary committee. K. B. CUMBERLAND, NG, Apr. '56.—Why geography? W. G. EAST, SGM, Apr. '56.—18th century geographer, William Guthrie of Brechin. A. A. GRIGORYEV, GJ, Dec. '55.—Soviet geography. S. B. JONES, GR, July '55.—Views of the political world. S. MOOKERJEE, GRI, Mar. '56.—A review of political geography. H. F. RAUP, A of G, Mar. '56.—U.S. in geographic literature. A. H. ROBINSON, A of G, June '56.—Necessity of weighting values in correlation analysis of areal data. A. SPILHAUS, GR, Oct. '56.—Control of world environment.

MATHEMATICAL GEOGRAPHY AND CARTOGRAPHY. H. P. BAILEY, GR, Apr. '56.—Grid of meridians and parallels for comparison and measurement of area. L. CHAMPIER, RGL, No. 2, '56.—De la carte morphologique à la carte agraire. A. W. KUCHLER, GR, Apr. '56.—Classification and purpose in vegetation maps.* A. W. KUCHLER, A of G, Dec. '55.—Comprehensive method of mapping vegetation. J. LEIGHLY, A of G, Mar. '56.—Uses of polyconic projection tables. T. ROBERTSON, A of Sc, Sept. '56.—Presentation of geological information in maps. M. SEBOR, RCG, No. 4, '55.—Problem of nature of cartography. J. C. WEAVER, GR, Oct. '56.—The county as a spatial average in agricultural geography.* W. F. WOOD, A of G. Dec. '55.—Use of stratified random in a land use study. J. I. S. ZONNEVELD, GT, No. 3, '55.—Air photo interpretation (in Dutch).

PHYSICAL GEOGRAPHY, including Climatology. D. F. W. BADEN-POWELL, PGA, July '56.—Correlation of the Pliocene and Pleistocene Marine Beds of Britain and the Mediterranean. G. F. CARTER and R. L. PENDLETON, GR, Oct. '56.—The humid soil: process and time. R. W. CLAYTON, GS, No. 2, '56.—Linear depressions (Bergfussniederungen) in Savannah landscape. C. A. COTTON, GJ, Sept. '56.—Rias *sensu stricto* and *sensu lato*. J. LEIGHLY, A of G, Dec. '55.—What has happened to physical geography? A. A. MILLER, A of Sc. Sept. '56.—The use and misuse of climate resources. J. A. STEERS and D. B. SMITH, GJ, Sept. '56.—Detection of movement of pebbles on the sea floor by radioactive methods. L. VILBORG, GA, No. 3–4, '55.—Uplift of stones by frost.

CULTURAL GEOGRAPHY. A. L. BANKS, GJ, June '56.—Trends in the geographical pattern of disease. G. V. JACKS, A of Sc, Sept. '56.—Influence of man on soil fertility. E. JONES, A of G, Dec. '56.—Cause and effect in human geography. A. M. LAMBERT, EG, Oct. '56.—Millionaire cities.

ECONOMIC GEOGRAPHY. W. A. ALBRECHT, GR, Jan. '57.—Soil fertility and biotic geography. A. ALLIX, RGL, No. 1, '56.—La banque et la géographie. J. H. ANDREWS, GS, No. 1, '56.—Some statistical maps of Defoe's England. H. P. BACON, J of G, Sept. '56.—Human waste and soil productivity. A. S. BESHKOV, GRI, Mar. '56.—The role of economic geography in planned economy. A. C. HARTLEY, A of Sc, Sept. '56.—Oil and industry. M. E. MARTS, EG, Apr. '56.—Indirect benefit analysis and repayment responsibility for irrigation projects. A. MELAMID, GR, July '55.—Natural gas transportation and political geography. E. T. PRICE, A of G, Mar. '55.—Values and concepts in conservation. H. REES, SGM, Sept. '56.—Shipment of petroleum to and from the ports of the United Kingdom. C. J. ROBERTSON, SGM, Apr. '56.—Expansion of the arable area. W. SMITH, IBG, '55.—Location of industry. G. VEYRET-VERNER, RGL, No. 2, '56.—Industrie en pleine expansion: l'aluminium.

TEACHING. E. BAXTER and K. MONTGOMERY, J of G, Sept. '56.—Creating environments for geographic education. G. T. L. CHAPMAN and J. E. WALTHAM, SGM, Sept. '56.—Teesdale: transect survey at school level. M. A. ERICSON, J of G, Nov. '56.—Helping students see what's there. H. F. GREGOR, J of G, Sept. '56.—Slide-projection techniques in the geography class. H. B. JOHNSON, J of G, Oct. '56.—Spatial feeling in geography teaching. G. LANGDON, J of G, Oct. '56.—Utilization of the comparative method in the analysis of geographical regions. R. B. McNEE, J of G, Nov. '56.—Geographic objectives in general education. M. V. PHILLIPS, J of G, Nov. '56.—Methods to improve skill in the use of geography vocabulary at the high school level. C. O. SAUER, A of G, Sept. '56.—Education of a geographer. C. E. SMOLSKI, J of G, Sept. '56.—Understanding current affairs thru geography. R. SUGARMAN, J of G, Oct. '56.—Geography learnings in camping. M. E. TRUSSELL, J. of G, Dec. '56.—Opaque projection as a teaching aid. D. J. WELCH and A. STONE, J of G, Nov. '56.—Geography workshop for elementary teachers.

BRITISH ISLES. Physical. R. COMMON, SGM, Dec. '56.—The border floods, August 1956. S. E. DURNO, SGM, Dec. '56.—Pollen analysis of peat deposits in Scotland. N. GEORGE, PGA, July '56.—Namurian Usk anticline. H. GODWIN, A of Sc, Sept. '56.—Quaternary history and the British Flora. S. GREGORY, GJ, Sept. '56.—Regional variations in the trend of annual rainfall over the British Isles. C. A. HALSTEAD, SGM, Apr. '56.—Climate observations in Scotland. M. V. LAURIE, A of Sc, Dec. '56.—Current trends in forest research in Britain. R. F. PEEL, GJ, Dec. '56.—Profiles of glacial drainage channels. F. M. SYNGE, SGM, Dec. '56.—Glaciation of northeast Scotland. K. WALTON, SGM, Sept. '56.—Rattray: A study in coastal evolution. W. W. WILLIAMS, GJ, Sept. '56.—An east coast survey: some recent changes in the coast of East Anglia.

Cultural. H. CARTER, GS, No. 2, '56.—Urban hierarchy and historical geography: a consideration with reference to Northeast Wales. H. C. CHEW, GJ, Dec. '56.—Changes in land use and stock over England and Wales 1939 to 1951.* G. L. DAVIES, SGM, Sept. '56.—The parish of north Uist. J. F. HART, EG, July '56.—Changing distribution of sheep in Britain. D. C. LARGE, EMG, Dec. '56.—Nottingham: its urban pattern. H. B. RODGERS, GS, No. 1, '56.—Market area of Preston in the sixteenth and seventeenth centuries. M. D. THOMAS, A of G, June '56.—Manufacturing industry in Belfast, N. Ireland.

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Cultural. J. P. COLE, GJ, Sept. '56.—New industrial area in Asiatic U.S.S.R. K. DZIEWONSKI, PG, vol. 28, I.G.U. supp. '56.—Detailed survey of land utilization in Poland. T. H. ELKINS, GJ, Sept. '56.—Thomas Banfield: an English traveller in the Siegerland. G. W. HOFFMAN, EG, Oct. '56.—Yugoslavia in transition: industrial expansion and resource bases. G. W. HOFFMAN, GS, No. 1, '56.—Political geography of a neutral Austria. S. JAATINEN and W. R. MEAD, EG, Jan. '57.—Intensification of Finnish farming. W. A. D. JACKSON, A of G, Dec. '56.—Durum wheat and the expansion of dry farming in the Soviet Union. W. B. JOHNSON and I. CRKVENCIC, EG, Jan. '57.—Changing peasant agriculture in Croatia, Yugoslavia. J. KOSTROWICKI, GJ, Dec. '56.—Geography in Poland since the war. A. MELAMID, GR, July '56.—Geographical distribution of Communities in Cyprus. R. E. H. MELLOR, GS, No. 1, '56.—Soviet Arctic research. D. R. MILLS, SGM, Dec. '56.—The U.S.S.R.: A re-appraisal of Mackinder's heartland concept. F. J. MONKHOUSE, SGM, Dec. '56.—Albert and Juliana: two great waterways. A. PRENTICE, SGM, Apr. '56.—Re-afforestation in Greece.

ASIA. Physical. K. BAGCHI, GRI, Mar. '56.—The Bartala-Matla interfluve—a preliminary study of deltaic problems. S. S. BHATIA, GRI, Dec. '55.—How arid is Delhi? J.-H. CHANG, A of G, Dec. '55.—The climate of China according to the new Thornthwaite classification. P. H. DAVIS, GJ, June '56.—Lake Van and Turkish Kurdistan: a botanical journey. S. SEN, GRI, Mar. '56.—Evaporation loss in the Damodar Basin. V. P. SUBRAHMANYAM, A of G, Sept. '56.—The water balance of India according to Thornthwaite's concept of potential evapotranspiration.

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